

Light Weight & Low Cost Power Bank based on LM7805 Regulator for Hand Held Applications

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Abstract- In this paper, a power bank has been constructed using LM7805 which has very simple construction. Power banks have become important in our life as it makes our life more convenient. In short, the simple way of construction of power bank and its working has been presented.

Keywords: Conventional Battery, LM7805, Solar energy, USB Power Supply, LED

I. BACKGROUND

We are living in electronics world. Wherever you go, whomever you see there will be atleast an electronic device with them. In this electronic age, mobile phone is playing an important role in each and everyone's life. It is used for communication purpose like calling, messaging. It can also be used for browsing. So, people use it most of their time and run out of charge. Everywhere and every time people can't get power sockets to charge their mobile phones. So, for their convenience, power bank is invented.



Fig. 1 Power Bank

II. INTRODUCTION

Power banks are used for charging smartphones and mobile tablet devices. A power bank is a portable device which supplies power from its built-in batteries through a USB port. USB power supply is used to recharge them. A power bank consists of rechargeable Lithium-ion or Lithium-Polymer batteries which are installed in a protective casing, which is guided by a printed circuit board (PCB) which provides various protective and safety measures.

III. POWER PROBLEM

Power has become a major problem in our country. Due to over population and developing country, power consumption is increasing day by day. Conventional power is non-renewable and so, once these powers are used; it cannot be regenerated. Non-conventional power is still under process to convert to electrical energy to its full potential. So, there is storage of power. Even though, there is shortage of power people don't know to save the power in an efficient way. Wastage of power is more.

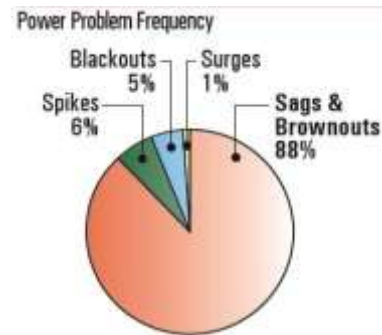


Fig. 2 Power Problems

IV. WHY POWER IS NEEDED?

Power plays a vital role in the electronic world. It is possible to convert electrical into any desired form. Low cost and uninterrupted supply of electrical energy is the primary need for the survival of industrial undertakings and our social structures. It is used for running many electrical and electronic appliances. The advancement of a country is measured in terms of per capita consumption of electrical energy.

Electrical energy has the following advantages:-

- Convenient form it is very convenient form of energy as it can be converted easily into other forms of energy. Eg. Electrical energy can be converted into light energy, mechanical energy etc.
- Easy control- it is easy for controlling and operation. Eg. A switch can be used to turn on or off an electric bulb.

- Greater flexibility- it can be transported from one place to another with the help of conductors.
- Cheapness- it is much cheaper than any other forms of energy.
- Cleanliness- it doesn't affect the environment and ensures healthy conditions.
- High transmission efficiency- it can be transported efficiently all over with the help of transmission lines.

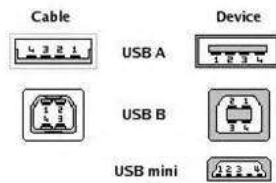
Without power, life would be difficult for all of us.

V. COMPONENTS REQUIRED

- USB port
- 9 volt battery and battery cap
- LM7805
- Blue LED

A. USB PORT

USB (universal serial bus), has four pins in it-1,2,3,4. 1st pin is positive (supply), 4th pin is negative (ground). 2nd pin is data +; 3rd pin data -. It is covered with aluminum metal to reduce the heat. We can connect mobile phones, tablets, mp3 players, iPad etc. It can also be used to charge them.



Pin	Signal	Color	Description
1	VCC	Red	+5V
2	D-	White	Data -
3	D+	Green	Data +
4	GND	Black	Ground

Fig. 3 USB Pin Details

B. CONVENTIONAL BATTERY/9 VOLT BATTERY

It was first introduced for the transistor radios. It has a rectangular prism shape with rounded edges and has a polarized snap connector at the top. It is commonly used in walkie-talkies, clocks and smoke detectors.

It is commonly made up of primary carbon-zinc and alkaline chemistry, in primary lithium iron disulphide and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium ion. Mercury-oxide batteries were once being manufactured and was in common use. But because of their mercury content, it was banned. Designations for these batteries include NEDA 1604 and IEC 6F22 (for zinc-carbon) or MN1604 6LR61 (for alkaline).

Most nine volt alkaline batteries (eg.carbon-zinc) are constructed of six individual 1.5V LR61 cells enclosed in a wrapper. They are smaller than LR8D425 AAAA cells by 3.5 mm. Primary lithium types are made up of 3 cells in series.

There are two terminals in the battery. The smaller terminal is circular and is positive and the larger terminal is hexagonal or octagonal and is the negative contact. Positive terminal is male and the negative terminal is female. Both the terminals are connected in a snap connector on one end. The smaller one connects to the larger one and vice versa. This connector is also used in the Power Pack series.

The only disadvantage of this connector is that two batteries can be connected easily together in short circuit, which discharges the batteries quickly, generates heat and possibly causes a fire.

The advantage of this battery is that it can be connected to each other in series to provide higher voltages.



Fig. 4 Conventional Battery

C. LM7805

It is a linear voltage regulator integrated circuits. It is used in electronic circuits which require a regulated power supply because of its low cost and it is easy to use. 7805 means it has a 5 volt output. It produces a positive voltage relative to a common ground. It has three terminals. Its design is very simple and it protects from overheating and short-circuiting.



Fig. 4 LM7805

D. LIGHT EMITTING DIODE

A light-emitting diode is a two-lead semiconductor light source. It is a p-n junction diode which emits light when activated. When a suitable voltage is applied, the electrons recombine with the electron holes within the device, which results in releasing of energy in the form of photons. This effect is called electroluminescence. The colour of the light emitted by the LED corresponds to the energy of the photon. It is determined by the energy band gap of the semiconductor. It consumes less energy, smaller in size, longer lifetime, improved physical robustness and faster switching.

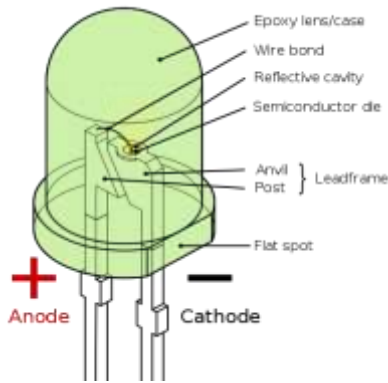


Fig. 5 Light-emitting device

VI. SPECIFICATIONS

- Capacity in Wh: Total power capacity is measured by multiplying mAh by voltage.
- Capacity in mAh: mAh stands for milli Ampere-hour. It measures the amount of power flow that can be supplied by a certain powerbank at a specific voltage.
- Simultaneous charging and discharging: It is needed to specify if the powerbank can be used while it is charging.
- Number of output USB ports: this tells the number of devices that can be charged simultaneously.
- Output current rating: this specifies the current rating that it can charge maximum. The higher the number, the better the powerbank. This can vary from output port to output port.
- Input current rating: input current rating is defined the amount of current the powerbank is able to draw at its maximum while getting charged.
- Safety Protections: Over Voltage Protection, Over Charge Protections, Over Current Protections, Over Heat Protections, Short- Circuit Protections and Over Discharge Protections are the common safety measures.
- LED Indications: The LED glows indicating the amount of charging ability left with the powerbank.

VII. SIMULATION OUTPUT

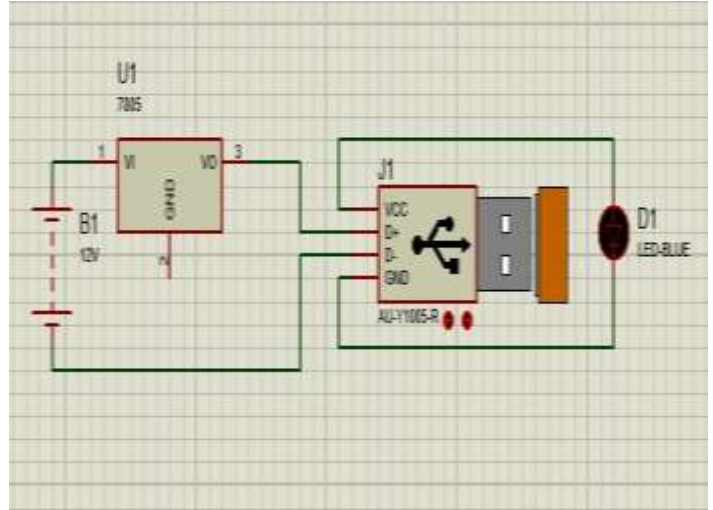


Fig.6 Without Power Supply

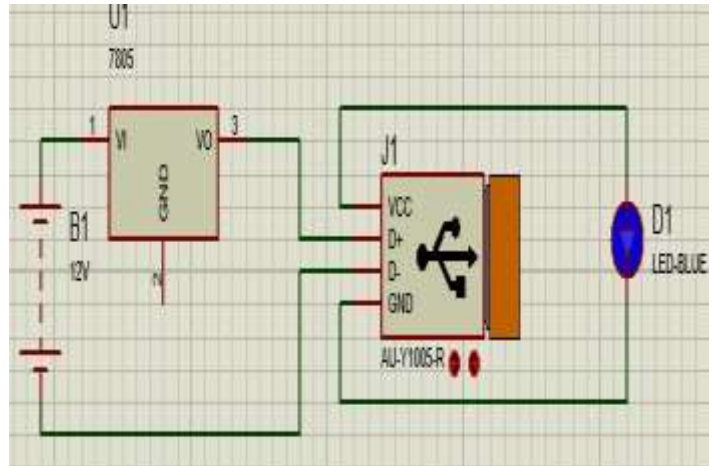


Fig.7 With Power Supply

VIII. ADVANTAGES

- Cost is low.
- It is portable.
- It can be used anywhere and anytime conveniently.
- LM7805 protects the device from overheating and short circuiting.
- It is easy to use.

IX. FUTURE WORKS

In future, the conventional batteries can be replaced by solar cells. It will have more advantages.

A. SOLAR CELLS

Solar cells are also known as photovoltaic cell. It is an electrical device that converts the energy of light into electricity by the photovoltaic effect; it is a chemical and

physical phenomenon. It is also used as a photo detector. It is made up of semiconducting materials.



Fig. 8 Solar Cells

B. SOLAR VS CONVENTIONAL CELLS

- Conventional batteries have poor performance at low temperature but solar batteries work efficiently whenever there is light.
- At high temperature there is an internal leakage in conventional battery but there is no such leakage in solar cells.
- Conventional battery converts chemical energy to electrical energy whereas, solar cell converts solar energy to electrical energy.
- Storage life of conventional battery is for 10 years but storage life of solar cell is more than the conventional battery.
- Conventional batteries are made up of finite resources. It means if once burned they cannot be replaced whereas solar power is renewable.

C. SOLAR CHARGERS

It is an electrical device that converts the energy of light into electricity by the photovoltaic effect. Generally, they are portable, but they can also be fixed mount. The fixed mount solar chargers are also known as solar panels. Solar panels are usually connected to the electrical grid whereas portable solar chargers are used off-the grid. Most portable chargers can obtain energy only from the sun.

X. CONCLUSION

Although the overall power generated by solar energy is small compared to conventional energies, it has a bright future. Electricity from solar panels in sun-rich countries can be cheaper compared to commercially generated electricity. As solar cells have more advantages than the conventional batteries, it can be developed to its full potential so that the solar portable power bank will be of more efficient.

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