

Electronic Charger Kit to Increase the Life of Lithium Batteries

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Received 2022 March 15; **Revised** 2022 April 20; **Accepted** 2022 May 10.

Abstract

Background: This article is entitled Electronic Kit for Battery Charger with Automatic Shut off. The automatic battery charger provided here is a type of Ni-Cd battery charger. An auto-extinguishing battery charger charges the battery. Objectives This article is entitled Electronic Kit for Battery Charger with Automatic Shut off. The automatic battery charger provided here is a type of Ni-Cd battery charger. An auto-extinguishing battery charger charges the battery. Methods: Rechargeable batteries store electricity/power from the grid for later use and can be easily recharged when they run out of energy. The purpose of this project is to design and build an electronic device that will supply electrical energy (charge) to the battery and it will be cut off after reaching 85% of the battery charge.

Keywords: Electronic Charger, Lithium Batteries, Kit

1. Introduction

The purpose of this project is to introduce technology to reduce power loss, which always happens without human intention. Another issue that should be noted is the health of the batteries. If the mobile battery chargers are charged in the range of 80 to 85%, they will have a significant impact on battery health.

Overcharging batteries not only shortens their life but also poses a serious threat to humans. This project is mainly based on battery charging automation. All of humanity is responsible for conserving energy resources. That is, electricity is a man-made source of energy.

An auto shut off charger is an electrical device used to charge batteries. This charger automatically shuts off the charging process when the battery is fully charged or set to normal. This will prevent the battery from charging too deep. The circuit automatically shuts off the battery charge. It is observed that regardless of the amount of discharge, most people connect the battery charger and regardless of the amount of charge or accuracy of energy consumption, they can use a device to automatically shut them off when charging. They cut off completely to prevent overcharging and possible explosion as well as reduce energy consumption [1]. In some cases, in an effort to provide fast service and respond to customer demand, the battery charger is adjusted to increase the charging current to reduce charging time. Such measures shorten battery life [2].

The charger is made up of various electrical and electronic components that are grouped for clarity in your main unit:

Power supply units

Regulator unit

Adjusted D.C charging units

An automatic battery charger circuit is a good option for people who do not like to consume too much energy in the battery charging process. Simply plug your battery into an automatic battery charger and you will see that our battery charges automatically. When the charge is complete, the battery turns off. The battery should never be overcharged with

the auto turn off battery charger. Many people can choose an automatic turn off battery charger instead of a manual one.

1. Objectives

This article is about designing and making an effective automatic battery charger to optimize efficient and stable power. A device designed from a circuit that performs charging, a circuit for reverse current protection, and a circuit to display the battery charge level during charging or rest mode. This special charger has a built-in protection unit and is fully automatic to protect the battery from overcharging because overcharging will damage the battery panel. When the battery is fully charged up to 80% to 85%, the full charge control monitors the full charge status of the cell or battery. At this level, the battery is fully charged and automatically shuts off. The design is simulated by Proteus simulation software and the prototype battery charger is implemented. And the results of its operational test is satisfactory. Careful design and construction are provided to ensure that the battery charger is reliable and easy to use.

Auto turn off battery charger can automatically control the power supply of the electronic device during charging. Automatic turn off battery charger for Ni-Cd rechargeable batteries automatically disconnects from power to stop charging when the batteries are fully charged.

Short charging time for mobile batteries necessitates the use of this article. However, the short charging time should also be considered system reliability. Where a short charge time does not damage the control system and battery. We offer the method of controlling battery charge and automatic shut off of this system. The controller is based on a constant voltage (CV) charge control scheme. In order to keep the parameters constant, this research prototype uses a DC-DC controller. Experimental results show that the charging period of the new controller is significantly reduced. In addition, the proposed controller is highly accurate and minimizes overcharging of the battery.

It can also be used to charge half-emptied cells. The block diagram of this article is shown in Figure 1.

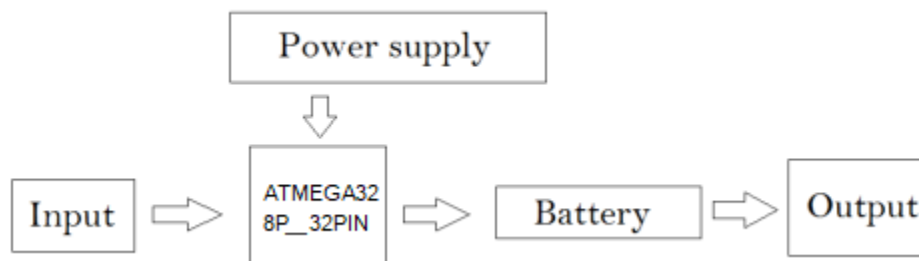


Figure 1. Charging diagram block

2. Methods

PCB

A printed circuit board mechanically supports electrical or electronic components using conductive paths, pads, and other features engraved on one or more layers of copper engraved on and/or between the sheet layers of a non-conductive substrate and connects electrically. The holes are connected in horizontal and vertical rows as shown below.

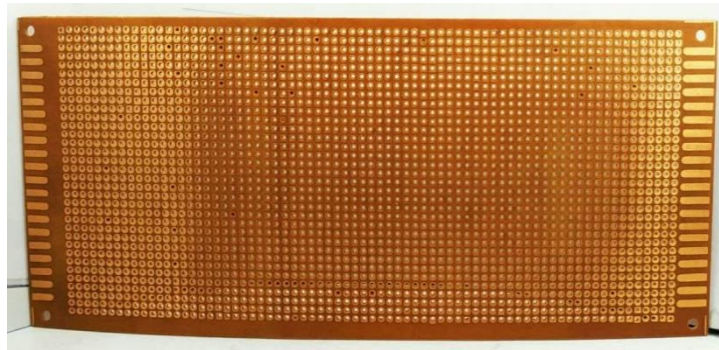


Figure 2. PCB board

Jumper Wires

These wires are used with boards and are generally 22 to 28 AWG solid core wires. Jumper wires can have male or female ends, depending on how they are used.



Figure 3. Jumper wires (male and female)

Potmeter

A variable resistor is also known as a Potmeter. These components can be found in devices such as light dimmers or radio volume controls. When you rotate the shaft of a Potmeter, the resistance in the circuit changes.



Figure 4. Potmeter

Atmega328P Microchip

Another electronic component you need to know is the microcontroller or MCU (microcontroller unit). ATmega328P is one of the most popular chips that you can program for many applications of all kinds, both DIY projects, even other

industrial projects and so on. It is one of the microchips that plaques use. In fact, it's basically an open hardware platform that has also contributed to its popularity.

El ATmega328P is a microcontroller created by Atmel and belongs to the mega AVR series. It currently belongs to Microchip. In relation to its parameters and the most prominent technical specifications, they are:

1. High-performance, low-power 8-bit AVR® microcontroller
2. Advanced RISC architecture
 - 131 Powerful Instructions - Maximum execution time of one hour cycle
 - 32 8 8 general work registration
 - Fully static operation
 - Maximum 20 megapixels at 20 MHz
 - Multiply 2 cycles on the chip
3. High-strength non-volatile memory components
 - 4/8/16/32K byte programmable automatic program memory
 - 256/512/512/1K EEPROM bytes
 - 512/1K/1K/2K internal SRAM bytes
 - Write / Clear Cycles: 10,000 Flash/100,000 EEPROM
 - Data retention: 20 years at 85 °C/100 years at 25 °C
 - Optional boot code section with independent lock bits
 - In-system programming by On-chip Boot Program
 - Reading operations during real writing
 - Programming lock for software security
4. Environmental features
 - Two 8-bit timers/counters with separate pre-sale and comparison mode
 - One 16-bit timer/counter with separate pre-sale, comparison, and recording modes
5. State
 - Real-time counter with separate oscillator
 - Six PWM channels
 - 8-channel, 10-bit ADC in TQFP and QFN/MLF packets
6. Temperature measurement
 - 6-channel, 10-bit ADC in PDIP package
 - USART programmable series
 - Master/Slave SPI serial connector
 - 2 byte serial connector compatible with Philips 12 C
 - Programmable watch timer with separate oscillator on chip
 - Analog comparator on the chip
 - Pause and awoken to change pins
7. Special features of microcontroller
 - Light on adjustment and recognizable brown reset
 - Internal calibration oscillator
 - Internal and external disconnection sources
 - Six sleep modes: idle, ADC noise reduction, power saving, power reduction, standby, and extended standby
8. I/O and packages
 - 23 programmable input/output lines
 - 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF, and 32-pad QFN/MLF
9. Operating voltage
 - 1.8-5.5 volts
10. Range of Temperature

- -40 °C to 85 °C
- 11. Degree of speed
- 0-4 MHz @ 1.8-5.5 V, 0-10 MHz @ 2.7-5.5.V, 0-20 MHz @ 4.5-5.5 V
- 12. Power consumption at 1 MHz, 1.8 volts, 25 °C
- Active mode: 0.2 mA
- Off mode: 0.1 micro mA
- Power saving mode: 0.75 μ A including 32 kHz RTC

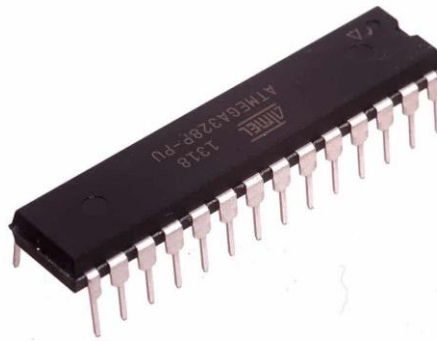


Figure 5. Microchip type of Atmega328P

Resistor

A resistor is a two-terminal passive electronic component used to resist or limit current. The resistor works on the principle of Ohm's law, which states that 'the voltage applied to the resistor terminals is directly proportional to the current flowing through'.



Figure 6. Resistor

Capacitor

A capacitor is made of two conductive plates with an insulator between them that stores electrical energy in the form of an electric field. A capacitor blocks DC and allows AC signals and is also used with a resistor in the timing circuit.



Figure 7. Different types of capacitors

Transistor

A transistor is a three-terminal semiconductor device. It is mostly used as a switching device as well as an amplifier. This switching device can control voltage or current. By controlling the voltage applied to one terminal, it controls the current through the other two terminals. There are two types of transistors: Bipolar junction transistors (BJTs) and field effect transistors (FETs). In addition, these can be PNP and NPN transistors.

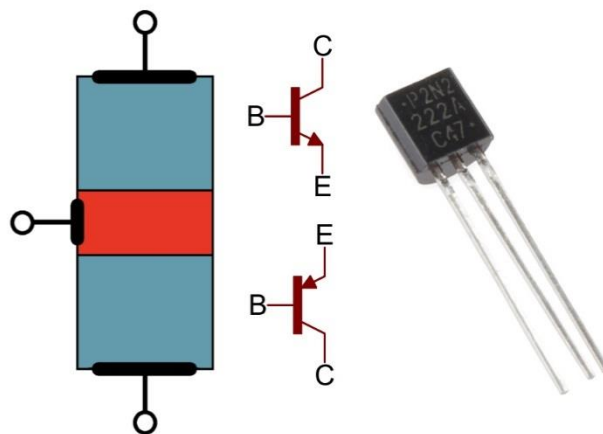


Figure 8. Schematic of a transistor

LED

The term LED stands for light emitting diode. It is a semiconductor device that is used to emit light whenever a current passes through. In semiconductor materials, charge carriers such as electrons and holes combine to produce light. When light is produced in solid semiconductor materials, these LEDs can be known as solid mode devices.



Figure 9. Types of LED

Switch

A switch is an electrical component used to connect or disconnect a conductor line in a circuit to cut off electrical current from one conductor to another. An electromechanical device is the most common type of switch that consists of one or more moving electrical contacts connected to other circuits.



Figure 10. Types of switches and pushbuttons

Automatic Battery Charging System

Electrochemical energy storage devices are known as batteries. There is an electrolyte in the battery as a place to store energy. During battery charging, electrical energy is stored in the electrolyte. In addition, in the discharge process, the energy stored in the electrolyte is released into the DC power supply. Batteries are an energy source that is still very common, because it is portable and can be used whenever needed. But charging a battery with a high current source causes to overheat so much that it raises the temperature, where high temperatures can reduce battery life. Another thing that can reduce the life of the battery is that the battery is full but is still supplied or the voltage used to charge the battery is higher or lower than the appropriate voltage range.

This paper presents the automatic charge controller. This is a device used to regulate the battery charge current. Therefore, it can minimize the occurrence of overcharging. The battery is overcharged because it is full. Overcharging can reduce battery life, which can damage the battery quickly. It actually informs to stop the battery charging system if the battery is full.

An auto turn off battery charger based on the Atmega328P microchip is provided here. This smart charger automatically shuts off when your rechargeable batteries are fully charged. The circuit consists of a bipedal multivibrator connected to an Atmega328P microchip. The stable output is fed to an ammeter (via diode D1) before it goes to the Ni-Cd battery to be charged.

The color LED (LED1) glows while charging the batteries and is available for user guidance.

It automatically disconnects from the power supply and stops charging until the batteries are fully charged, i.e. when the LED is off. They are used as an alternative source during power outages and are suitable for home applications.

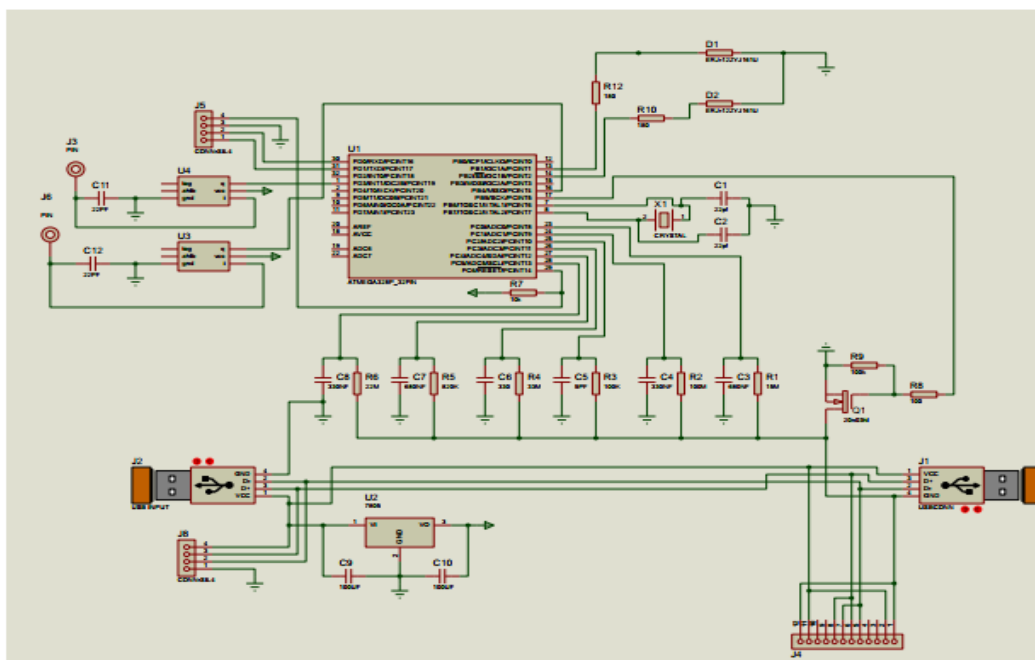


Figure 11. Schematic circuit drawn by software

3. Results

In this paper, it has been successfully established the automated design of a constant voltage (CV) based battery charging system for disconnecting the battery charger

4. Discussion

The proposed method can control the voltage applied to the converter. It can be seen from the experimental results that the designed system works well. And after reaching the desired charge or full charge of the battery, the charging current is cut off so as not to damage the system and mobile batteries, etc. Then the charging process stops automatically.

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