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A Review of Power Bank with Buck Boost Converter

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ABSTRACT: This study looked at the functioning of a battery power bank using series-connected buck–boost-type battery power modules (BPMs). Each BPM was made up of a battery pack and a buck–boost converter for independently regulating battery currents. Load voltage regulation with charge equalisation among batteries was done using a suggested discharge scenario by regulating battery currents in accordance with their state-of-charges (SOCs) calculated by real-time battery-loaded voltages observed under the same operating situation. Furthermore, fault tolerance was implemented in order to disconnect depleted or defective batteries from the battery power bank without disrupting the system. Experiments were conducted to verify the effectiveness of the discharging scenario for a laboratory battery power bank with four series buck–boost BPMs.

KEYWORDS: Fault tolerance; state-of-charge (SOC)

I. INTRODUCTION

A Power bank is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol depends on the size and type of the battery being charged. Some battery types have high tolerance for overcharging and can be recharged by connection to a constant voltage source or a constant current source; simple chargers of this type require manual disconnection at the end of the charge cycle, or may have a timer to cut off charging current at a fixed time. Other battery types cannot withstand long high-rate over-charging; the charger may have temperature or voltage sensing circuits and a microprocessor controller to adjust the charging current, and cut off at the end of charge. A trickle charger provides a relatively small amount of current, only enough to counteract self-discharge of a battery that is idle for a long time. Slow battery chargers may take several hours to complete a charge; high-rate chargers may restore most capacity within minutes or less than an hour, but generally require monitoring of the battery to protect it from overcharge. Electric vehicles need high-rate chargers for public access; installation of such chargers and the distribution support for them is an issue in the proposed adoption of electric cars. In short, Power bank is portable charger which can be used in charging your mobile phone, mp3, mp4, ipad and other digital products **survive for the whole day when used continuously.** Therefore, in order to solve this annoying problem, through continuous research and exploration, finally a new technology power bank has been developed. It can solve a number of mobile devices power supply problems. Also, the safety of power bank is continuously valued by the people. Power bank must have protective measures for short circuit, battery overcharge and over discharge, thermal shutdown and other power supply problems. There should be a high-performance power management technology

II. THE CONCEPT

The latest twenty years, the functioning presentations and the future of the battery-fueled battery have been basically chipped away at as a result of the creating types of progress in battery materials and developments. This has worked with high-power applications like electrical vehicles (EVs) and energy amassing pads in electrical power frameworks [1,2,3]. Since a battery cell voltage is unreasonably low for most applications, all things considered, different cells are series-related with supply an adequately high voltage. Potentially the primary cycles during amassing

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is to sort the as of late coordinated cells by their most noteworthy usable cutoff, inside impedance, and open-circuit voltage to ensure consistency in their functioning ascribes [4,5]. Nevertheless, there is some difference among batteries since a compromise should be made between the consistency and the gathering cost. Thusly, the uniqueness among cells or battery packs may regardless be expanded after cyclic charging and delivering cycles, causing risky charge disparity and inciting cheating or overdischarging in specific batteries [6].

Commonly, a battery the board system (BMS) with an additional charge equalizer is required to direct the anomaly among the state of-charges (SOCs) of the batteries, which are assembled into a battery power bank [7,8,9]. The additional BMS and charge balance circuits bring an additional creation cost and more critical energy disasters. On the other hand, segregated battery power, whereby each cell or single-stuffed battery is furnished with a connected power electronic converter to be a battery power module (BPM), has been acquainted with adjust to this issue [10]. With an especially detached plan, battery streams can be controlled solely, working with battery the leaders with SOC evaluation and state of-prosperity (SOH) appraisal. A battery power bank can be outlined by different BPMs related in series or equivalent for accumulating higher voltage, power, and energy. With a bidirectional converter, charge evening out can be made during either charging or delivering stages [11,12,13]. A charging circumstance reliant upon a consistent current/steady voltage (CC-CV) plot has been proposed for the equivalent buck–support BPMs to totally utilize the available power given by the dc source, which suggests that the entire charging association can be more capable [12]. During the charging cycle, the battery charging streams are overseen according to their nonstop SOCs gathered by the coulomb counting technique for facilitating the charge disproportion among batteries. The delivering movement of the buck–support type BPMs with series yield in the determined conduction mode (CCM) and the discontinuous conduction mode (DCM) was analyzed in [13], in which significantly better return voltage was gotten by help change similarly as by series game plan. The ampleness of performing blame evening out for BPMs has in this manner been first off affirmed in these work

III. WORKING

They have microprocessor controlled circuitry to control charge voltage current to the 3.7V lithium batteries which are either cylindrical lithium ion or low profile Lithium polymer. There is also a step up DC-DC con- verter to boost the battery voltage up to the 5V output for the USB output. Protection circuits are there to prevent over charging, over dis- charging, over voltage, short circuit, over current and overheating

This depends on the capacity of the Power Bank and the device being charged. Fully charged smaller Power Banks will charge a Smartphone once while larger capacity models will charge a Smartphone up to five times and a tablet twice. Should last quite a long time. A lithium battery should last a good two or three months but it depends on the design of the power bank and how much drain is on the battery from the internal circuitry. They should certainly last long enough for anyone to use them for charging their phone over a week or two or more.

IV. HARDWARE IMPLEMENTATION

Couldn't be simpler! For charging you use the USB lead supplied with the charger and plug the large USB connector into the output socket of a standard USB AC-DC charger or a PC and the micro USB charger into the power bank. If you don't have a phone charger that has a USB socket but has a flying lead output then you will almost certainly have a micro USB terminated on the other end of the lead. Simply plug the micro USB connector in the power bank to charge. It doesn't matter whether you plug the power bank into a 1A or 2A USB charger as it will only take the current required to charge its internal battery. You cannot over charge. For charging your mobile device simple plug the large USB socket into your power bank and the other end into your mobile device. This will either be a micro USB connector, iPhone or mini USB. Inside is a microprocessor control PCB with fuel gauge to show the charge level of batteries and the Lithium batteries, some versions feature an LED torch, and some have a built in solar panel to charge from the sun. This depends on two things, the size of the batteries and the rating of the charging circuit within the power bank. This could be from 500mA on some small capacity products up to 2A max for larger units (max USB output) In general small units may take 3-4 hours and high capacity ones up to 15 to 18 hours.

V. COMPONENT SELECTION AND PERFORMANCES

As discussed, proper component selection is very important as per the electric specification to get the better efficiency. Power Bank or Portable Charger are specially made to provide the backup to other devices thus efficiency matters the most, because it is the only think for which it has been made. The power bank with better efficiency can

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give incredible power, thus proper selection of component is must. The most accuracy is needed in the selection of capacitors and inductor. Inductor plays very important role in the Buck and Boost mode. The current specification of the inductor is so selected that it should not be lower than that of MOSFET current, also the inductor should not saturate at minimum voltage of the battery thus proper value and proper current is very important for the proper working of device. The tolerance level and the value of capacitor and the resistance are also very important to get the proper rated input and voltage. Protection and Salient Features Different protection features has become the need of the product as most of the expensive devices are connected to the portable chargers. Some of them listed below with detailed explanation, Over Voltage Protection, whenever the device is getting charged and if suddenly the voltage rise then this feature helps to protect the device by making the charging current negligible to zero. Short Circuit Protection, device may get damage by any internal short circuit or if any external short circuited device is connected to it, thus it is very much necessary that the power bank should have internal short circuit protection. Reset Protection, if the device is having integrated over voltage protection then normally whenever there is rise in voltage the product should get reset and whenever the voltage comes in its charging range it should get on automatically. Over Current Protection, the circuit of device should be such designed that it should not deliver over current to the external devices. Thermal protection and thermal shutdown, thermal protection is related to the temperature of the printed circuit board, it should always work in its specified range, the proper working range of the power bank

VI. CONCLUSION

A battery influence set aside cash with series buck–support type BPMs has been proposed in this investigation to recognize charge balance, yield voltage rule, and variation to interior disappointment. With related buck–support converters, the drained or hurt battery can be viably isolated just by killing the contrasting powerful power switch without the need of an extra mechanical switch. Moreover, the BPMs in the power bank can be independently controlled. A delivering circumstance is modified to execute charge change and weight voltage rule all through the delivering cooperation. With bidirectional BPMs, charge evening out can be made during either the charging or the delivering stage with no extra changing circuit. This work is revolved around the delivering movement since charge change can be refined even more viably for the charging stage since voltage rule isn't needed. With the proposed delivering circumstance, charge evening out can be developed before the completion of the delivering. As such, the battery power can be utilized even more capably. This can work with charge change for the going with charge stage. In this assessment, the SOC appraisal is made by perceiving the stacked voltage under the same delivering current. The different SOC appraisal computations likewise as the delivering circumstances can be tweaked without liberal changes on BPMs for extra overhauls

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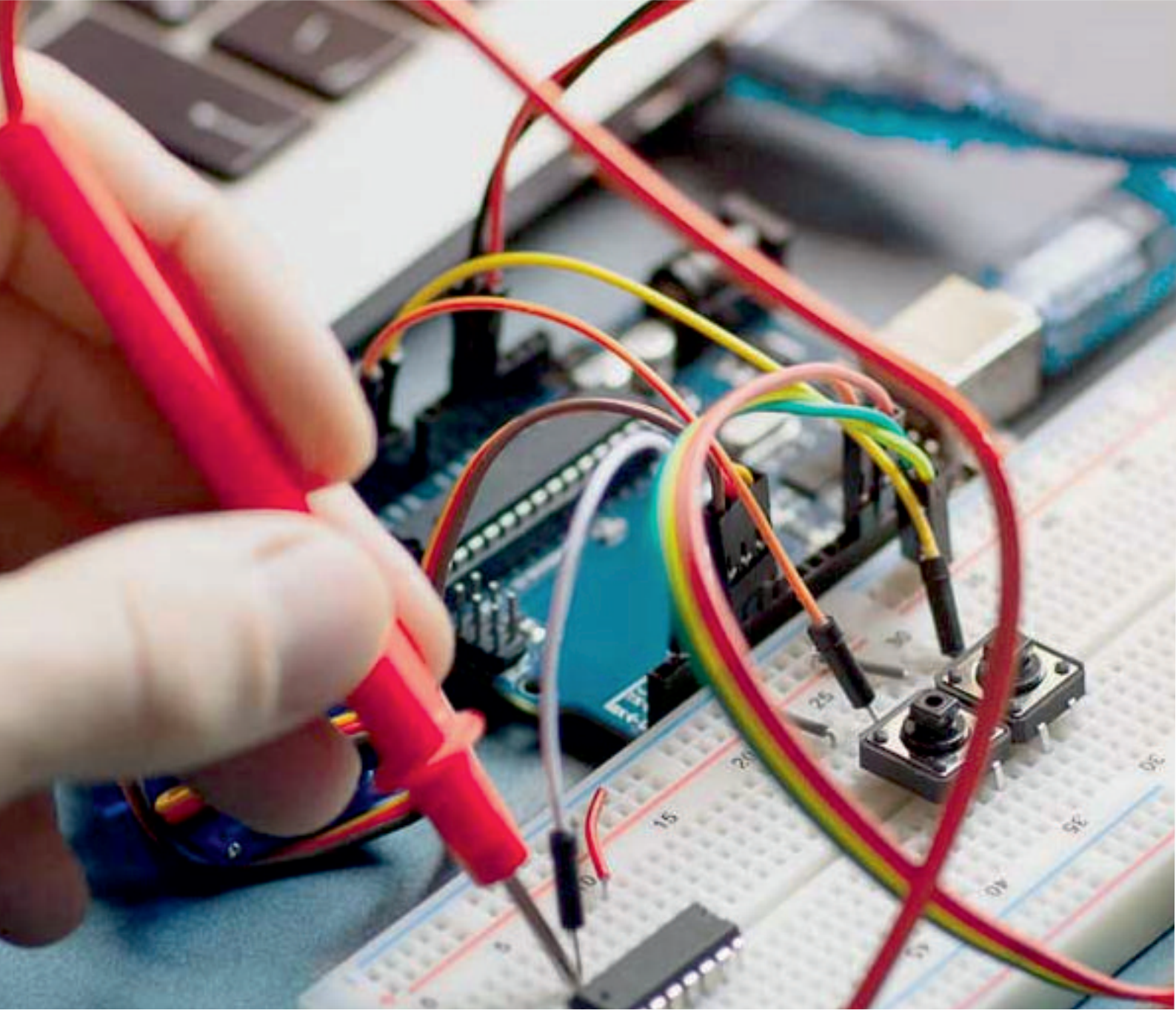

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