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To Create Portable Power Bank-To Charge Dual Devices

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ABSTRACT
The project involves the design and development of a power bank capable of charging two devices simultaneously. The power bank will incorporate dual USB output ports with varying voltage and storage capacity specifications to cater to a wide range of devices. It will be equipped with a high capacity lithium- ion battery ensuring efficient energy storage and delivery. The power bank management circuit will feature overcharge,over-current,andshort-circuitprotectiontoensuresafetyduring operation.Thepowerbankwillalso be equipped with a DC-DC converter and fast-charging protocols to minimize charging time. Additionally, itwill be equipped with LED indicators to display the battery status, charging status, and output status. Thisproject addresses the growing demand for efficient and portable energy solutions, making it ideal for daily use and travel.

Keywords-DualUSBoutputports,DC-DCconvertors,LEDindicators,Lithium-IonBatteries

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I. INTRODUCTION

The concept of being able to charge mobile phones on the go has been a pleasant help to almost everyone in the present times. Ever since the increasing abilities and the decreasing cost of smart phones, their utility has increased but their power consumption is high. The present day smart phones have a very large storage capacity and theparallelism with respect to apps associated withthem is increasing rapidly. Running many applications at a time causes the phones to drain out quickly. Although increased charge consumption for a host of parallel and quick applications is a good bargain, this also calls for the phone being charged frequently. As power supply sockets are notavailable all the time, power banks come in handy. The power banks available in the market do not have the ability to extend beyond a fixed number of ports. The design is rigid to ahigh extent. The cost ofthese power banks is comparatively very high as well. Other than that, using the present day power banks, wecannotdomuch, otherthanchargingphones. Say, we need to use some other USB device like a USB light or music player with USB connection. They cannot be done easily with them. In order to power those devices, we will have to do so separately. The followingarticledescribesanotherinnovativedesign to construct a power bank that reduces these problems to a great extent.The major components usedinthe workingofthepowerbankdesignarethe USB cable, IC 7805 and the Battery [1].

II REQUIRED COMPONENTS

USBCABLE: The USB data cable mainly consists of an outsourcing material -braided shielding net - aluminium foil -copper wire .the inner most layer is covered with a insulating jacket material which transmits the data signals and current and in thisUSBdatacablethereisaplasticshellwhich

protects the wires ,and the braided mesh and aluminium foil layer is used for shielding .
Ground wire (GND or GROUND): The colour is usually black or brown, It is also known as the neutral wire Its function is to ensure that thepotential of the circuit is stable, thereby ensuring the reliability of data transmission.

Readthedataline(Data+orUSBPort+):Thecolour isusuallygreen.Itcarriesthedatasignalsent from the device, telling the receiving device "I have some data to send to you". As as signal output line.
Write data line (Data- or USB Port-):The colour is usually white, as a signal input line. It receives data signals from other devices. These two data lines worktogethertoensurethattheinformationbetween the devices flow smoothly.
Power line (VCC or VBUS): Usually red in colour, with +5V DC power supply,as the positive line of the power supply. This is like the "power source" of the USB cable,It providesthe power required by the device to ensure that the device can function and charge normally [2].

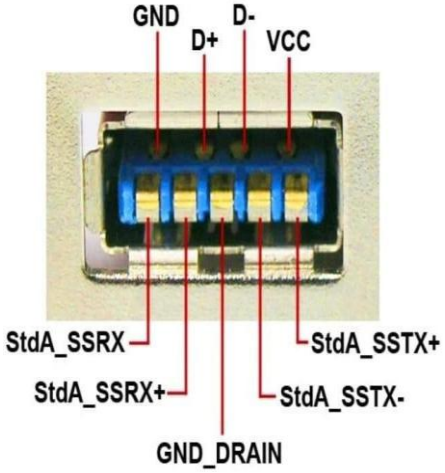

Fig1.StructureOfUSBCable

BATTERY: In comparison with other commercial rechargeable batteries, Li-ion batteries are most preferabledue to their higher specific energy, higher energy density, higher energy efficiency, a longer cycle life, and a longer calendar life. Lithium ion batteries are used for multiple applications such as, electronics, toys, power tools and electric vehicles. More niche uses include backup power in telecommunications applications. Power banks are generally rechargeable lithium-ion or lithium-polymer batteries that are used to provide a portable source of power for electronic devices [3].

Fig2.LI-IONBattery

The choice of battery cell material and model significantly impacts the performance, safety, and cost of power banks. Lithium-ion and lithium polymer batteries are the most common, each with their own strengths and weaknesses. Models like 18650 and 21700 for lithium-ion, or 606090 and 1260100 for lithium polymer, offer various benefits depending on the application. Emergingtechnologies like graphene and solid-state batteries holdpromiseforthefuture,potentiallyofferingeven better performance and safety A lithium-ion (Li-ion) battery is an ideal choice for power banks designedto charge multiple devices due to its high energy density, efficiency, and ability to handle substantial current output. Li-ion batteries are compatible with advanced charging technologies such as Quick Charge and Power Delivery (PD), ensuring faster charging for high-capacity devices like tablets or laptops while maintaining efficiency.These batteries can handle 300–500 full charge cycles, providing a reliable solution for daily use [4].

POWERBANKMODULE:

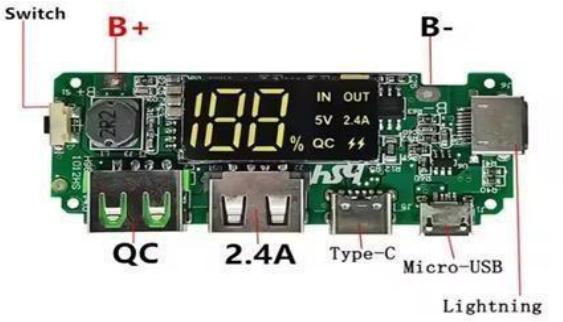

Fig3.PowerBankModule

It is a ROBODUINO 18650 Lithium Battery charging module with Dual USB 5V 2.4A Minitype-c Power bank module [5].
Protection: overcharge protection, overdischarge protection, short circuit protection, constant current.

III BLOCK DIAGRAM

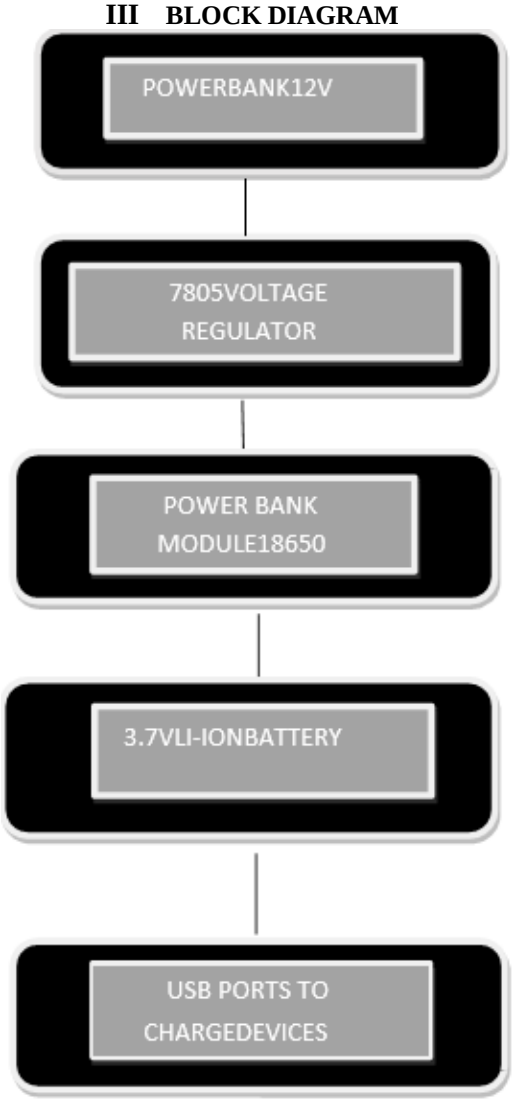

Fig4.BlockDiagram

Thecircuitisconstructedasshown below(Fig5.)so thatit canchargedifferent devicesat thesame time .
The circuit diagram is the visual representations of itselectricalconnectionsandcomponentsthatused in making the power bank.given below is thedetailed information about circuit diagram.

Key Sections of the Power Bank Circuit:

Input Section: USB Port: Used to charge the power bank's internal battery.
Battery Charging Circuit: Charging IC (e.g., TP4056): Regulates the input voltage and current to charge the lithium-ion or lithium-polymer battery. LED Indicators: Show charging status (e.g., charging, full).
BatterySection:BatteryPack:A3.7Vlithium-ion or lithium polymer battery with a capacity of 10000mAh. Battery Management System (BMS): Protects against overcharging, over discharging, and short circuits[3].
Output Section: USB Output Ports: Deliver 5V to charge external devices.

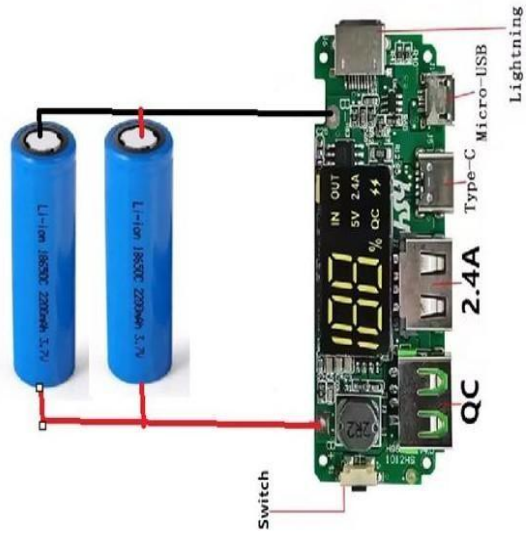

Fig5.CircuitDiagram

IV WORKING

When two Li-ion batteries each of 5000mAh are connected in parallel , these batteries totaling up-to 10000mAh capacity. These batteries are connectedto the power bank module , when connected the Li-ionbatteriespercentageisdisplayedonthe DIGITALDISPLAY.Powerbankmodulehasdual output ports and input ports. The Input ports in the module are Type-C, Micro-USB which are used for backup powersupplyofthepower bank.TheOutput ports in the module are QUICK CHARGE,2.4A to charge the electronic devices like Mobiles , Smart watches,Earpodescase,Bluetoothdevicesand etc...Ourpowerbankhassmallswitchwhich isused for turning ON and OFF the device and to look atthe battery percent on digital display of the power bank module.
The QC is used to charge the external devices quick and the 2.4A port is used to charge the external devicesnormally .Tochargethepowerbankittakes approximately 40-45 minutes. Once the power bank is charged it can charge two devices simultaneously. When two devices are connected the digital display indicates 5V(2.4A) AND QC (Quick Charge) [6].

V RESULTS & DISCUSSION

We created a portable power bank to charge to charge two devices simultaneously of capacity 10000Mah. Which can charge an average capacity device 2-3 times [7].

We have used 2 Lithium-ion batteries of each 5000Mah capacity .the module is portable with backup power supply with an input that matches the 5.0V adapter to charge the internal battery. This power bank module comes with overcharging protection, over discharge protection, short circuited protection and constant current. We enclosed this circuit with MDF board [8].

Fig6.ConnectionOfCircuitWithLI-IONBatteries and Power Bank Module

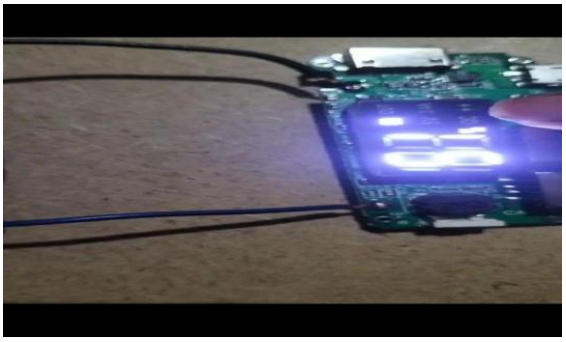

Fig7.DisplayingChargingStatus

Fig8.WorkingOfDIYPowerBank

VI CONCLUSION

This design will help in reducing overall cost of the device and also helps people to relax in reducing the need of phone chargers and separate chargers for USB devices. It will definitely help the people over the days, as, the speed and advancements in phones areatanexponentialratewhichdecreasesthecharge of phones greatly. Hence, This is an easier solutions tophonecharging.Thiswillalsoprovehelpfultothe newly emerging wearable electronic gadgets as, the size and power rating is ideal for that usage as well. This review paper has explored the concept of building a DIY power bank. We have discussed the various benefits of such a device, including its portable nature ,versatility ,and cost effectiveness. Our analysis has shown that DIY power bank is a viableoptionforindividualswhoneedareliable source of power for charging their devices. Wefound that building a power bank is astraightforward process that involves selecting a battery type, purchasing the necessary components, and testing the power bank for functionality and safety. Overall, the DIY power bank provides a practical and cost-effective solution for individuals whoneedareliablesourceofpowerfortheir devices.

REFERENCES

[1]. Mendel, C. W.; Savage, M. E.; Zagar, D. M.; Simpson, W. W.; Grasser, T. W.; Quintenz, J. P. (1992). Experiments on a current-toggled plasma- opening switch. Journal of Applied Physics, 71(8), 3731–. doi:10.1063/1.350883

[2]. J. F. Benage et al., "Experiments on planar plasma flow switches at Los Alamos," Digest of Technical Papers. 11th IEEE International Pulsed PowerConference(Cat.No.97CH36127),Baltimore, MD, USA, 1997, pp. 1233- 1238 vol.2, doi: 10.1109/PPC.1997.674569.

[3]. S. V. Satyanarayana and P. Madhavi, "Big Data Analytics for Electrical Systems using Machine Learning Algorithms," 2023 IEEE 3rd International Conference on Technology, Engineering, Management for Societal impact using Marketing, Entrepreneurship and Talent (TEMSMET), Mysuru, India, 2023, pp. 1-4,doi: 10.1109/TEMSMET56707.2023.10149919.

[4]. K.H. Finken, U. Ackermann ,Institute für Experimental physik V, Ruhr-Universität Bochum, 4630Bochum,West GermanyReceived6July1981, Available online 19 September 2002. https://doi.org/10.1016/0375-9601(81)90959-2

[5]. Kołek, Jacek, and Marcin Hołub. "Practical design of a high-voltage pulsed power supply implementing SiC technology for atmospheric pressure plasma reactors." Applied Sciences 9.7 (2019): 1451. https://doi.org/10.3390/app9071451.

[6]. https://doi.org/10.1016/j.epsr.2008.09.017K.C. Divya;JacobØstergaard(2009).Batteryenergy

storagetechnology for power systems Anoverview.79(4),511520.doi:10.1016/j.epsr.2008.0 9.017

[7]. P. Madhavi and S. V. Satyanarayana, "Data Analysis of Electrical Systems Using Machine Learning Algorithms," 2022 First International Conference on Artificial Intelligence Trends and Pattern Recognition (ICAITPR), Hyderabad, India, 2022,pp.1-4,doi: 10.1109/ICAITPR51569.2022.9844178.

[8]. Sarakinos, K., Alami, J. and Konstantinidis, S., 2010.Highpowerpulsedmagnetronsputtering: A review on scientific and engineering state of the art. Surface and coatings technology, 204(11), pp.1661- 1684. https://doi.org/10.1016/j.surfcoat.2009.11.013