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Implementation & analysis of battery, super capacitor & solar PV powered electric vehicle

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Abstract: This paper adds to the examination issue relating to the administration of various vitality sources on-board an unadulterated electric vehicle; especially the vitality thick footing battery and the power thick super capacitor or ultra-capacitor. This is accomplished by dissecting constant information on the communication between 40W sunlight based board to 12V lead corrosive battery pack and super capacitor module associated in parallel while endeavouring to satisfy the heap requests of the vehicle.

Keywords: Super capacitor, ESC, pV, SOC, Battery, BT, SC, REG.

I. INTRODUCTION

This paper starts by giving a short foundation on electric vehicles as far as fundamental arrangements, favourable circumstances and hindrances and furthermore the crossover vehicle setups. It continues to portray different battery sciences that are utilized as a part of the present electric vehicle and furthermore the specialized language related with battery advances. A vital term called Condition of Charge (SOC) of a battery is depicted and in addition a few techniques to compute it. A colossal bit of this examination is committed towards exploring a specific gadget's utilization or significance in the consistently developing electric/half breed vehicle industry; the super capacitor or super capacitor or Electric-Twofold Layer Capacitor (EDLC). The essential structure and attributes of the supercapacitor is tabled out and also its inborn advantages and disadvantages. One component which stands out is its powerful thickness which is exceptionally complimentary to show day battery advancements. A careful writing survey is displayed on various/cross breed vitality hotspots for driving electric/half and half vehicles with specific accentuation on supercapacitors. The difficulties looked by different specialists in this field are delineated which are related with vitality administration of the numerous vitality and power sources. Different blend calculations have been proposed and come about indicated running from fluffy rationale, neural systems, and hereditary calculations to help vector machines.

II. LITERATURE SURVEY

Analysts everywhere throughout the world are taking a shot at enhanced battery innovations to compensate for the drawbacks specified previously. The consequences of this examination will go far in deciding if EVs are completely received later on. Electric autos are mechanically substantially less difficult than both gas autos and power module autos. There is no engine oil, no channels, no start plugs, and no oxygen sensors. The engine makes them move part, there is no grip, and the transmission is considerably less difficult. Because of regenerative braking, even the rubbing brakes will experience little wear. The main administration that a very much composed electric auto will requirement for the initial 100,000 miles is tire administration and examination. Until the point when an electric auto producer accomplishes sufficiently high deals to approach a gas auto maker's volume efficiencies, electric autos should contend on different grounds other than cost. Beside the conspicuous discharges advantage, there is another way that an electric auto can endlessly beat a fuel auto – in a word, torque. A fuel motor has next to no torque at low rpm's and just conveys sensible strength in a limited rpm run.

III. OBJECTIVE

This paper is committed to the exploration, demonstrating and inevitable execution of a battery-supercapacitor crossover vitality source with a specific end goal to control an electric vehicle. This is in acknowledgment of the declaration that the electric vehicle will be a huge partner in future transportation frameworks. A developing worry in this day and age is natural insurance and vitality protection. Car producers are creating other options to existing petroleum derivative driven vehicles. This has cleared path for the advancement of Electric Vehicles (EV) and Hybrid

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Electric Vehicles (HEV). While HEVs have a tendency to decrease the outflows from inside ignition vehicles because of more noteworthy fuel proficiency, they don't totally tackle the issue. Electric vehicles then again are significantly more vitality effective, create definitely no tail pipe outflows and require less support when contrasted with the traditional inside burning motor (ICE) vehicles. In any case, the reason the car business has not gone unadulterated electric or ready to contend positively with existing fuel autos, lies in the inalienable issue of existing battery advances. Indeed, even with ICE vitality transformation proficiency figures of underneath 20%, the vitality thickness (Joules/kg) of oil far outperforms the vitality thickness of any known battery innovation. Batteries are the feeble connection in EVs right now. The absence of a solitary sensibly valued vitality stockpiling gadget that can at the same time give high power thickness and high vitality thickness for EVs has been the fundamental hindrance to the acknowledgment of EVs as the principle type of private and open transportation.

IV. PROPOSED SYSTEM ARCHITECTURE

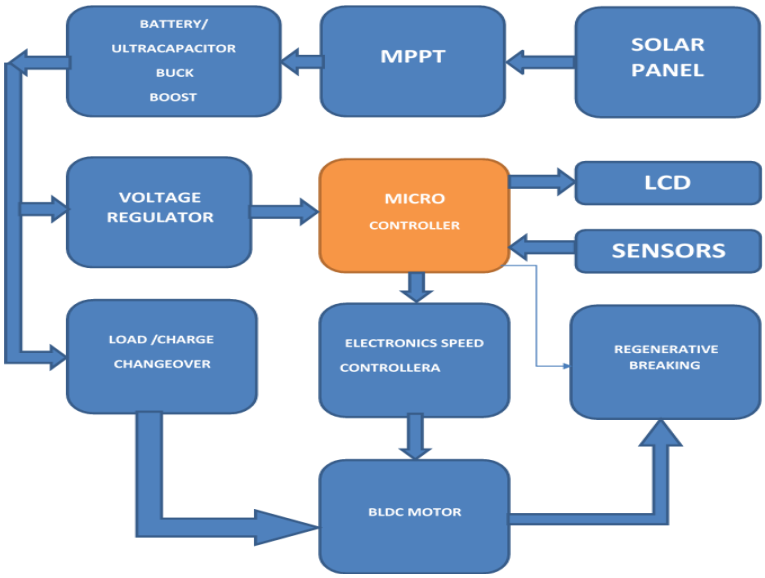

Fig. 1 Block Diagram Here, in this project we used 12V DC 40 W solar panel as a natural power charging source. At time when solar energy is available, generated power is fed to buck boost convertor via MPPT circuit. Solar Panel voltage is not in condition to feed directly to load, hence we used MPPT means maximum peak Power Transfer. By use of MPPT Circuit we reduced the voltage fluctuations within Solar panel output. We took advantage of MPPT is, we can boost solar generated voltage and within low sunlight system workflow become uninterrupted. As mentioned in earlier chapter, we used total three energy sources to drive the system. Regular Battery & ultra-capacitor are two different entities, which are operated in complementary or co operational method. To charge these two entities, we used buck-boost convertor independently to both of them. Input to buck-boost is can be Solar panel only in case of battery but ultra-capacitor has two sources to get charged, one is solar panel via buck-boost and another one is regenerative breaking operation voltage. As our system complements each sources within the system. Hence we required another block to execute the operation like load-charge. In default stage, battery is used to acquire load and ultra-capacitor is in charging via solar panel mode. Both sources couldn't operate simultaneously in charging or load condition. For these block we used SOC and Sensor inputs as feedback or execution parameter. The heart of the system is microcontroller, which reads sensor reading and accordingly to algorithm requirement, controller execute commands such as buck-boost signals for both battery and ultra-capacitor, changeover relays, LCD. Microcontroller also control the load condition and regenerative breaking condition as per accel-deaccel status by user. Liquid crystal Display is used here to show the status of current operation mode along with voltage levels of each sources. It receives commands from controller to display text accordingly. The sensors used in our system are voltage sensor and position sensors. All of these are resistive type voltage sensor. The main use of these sensor are to read real time data and use that data as input or feedback to execute the operation as per algorithm. The role of this block in our system is to operate BLDC motor as per used input from resistive accelerometer switch. In this block, microcontroller sends the command to ESC to run the motor with specified speed over single line of PWM command. ESC have got its own controller which reads the master controller command and accordingly generates the PWM signal to 6 MOSFET to excite the three winding of BLDC individually. As we used ultra-capacitors in our system, we took advantage of the property of ultra-capacitor. We used three phase bridge rectifier to generate DC from reverse AC signal in BLDC windings. That regenerative signal is enough to charge the ultra-capacitor.

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V. PROPOSED SYSTEM FLOW

Mode 1. At the point when PV is accessible and both the stockpiles are charged over their ostensible voltage. In this mode, the DC interface is kept up by the battery. Battery being a steady source is favoured for controlling the DC interface voltage. PV keeps running on MPPT as said above and conveys all the created capacity to the heap as both the stockpiles are over their ostensible qualities. UC then again, being above ostensible voltage, should be released and kept up at its ostensible voltage. It is released through the heap amid the speeding up mode. Amid de-increasing speed the overabundance vitality is dispersed through mechanical braking.

Mode 2. At the point when PV is accessible, battery is charged over its ostensible rating and UC is underneath its ostensible voltage. Battery being adequately charged directs the DC interface voltage. PV charges the UC, which is beneath its ostensible voltage. UC can't give increasing speed control under this mode of activity. No one but battery can bolster the additional power required amid increasing speed. This confines EV's greatest speed amid this mode. Be that as it may, UC can be used in recovery mode to assimilate additional power produced by the heap. It abstains from cheating of the battery.

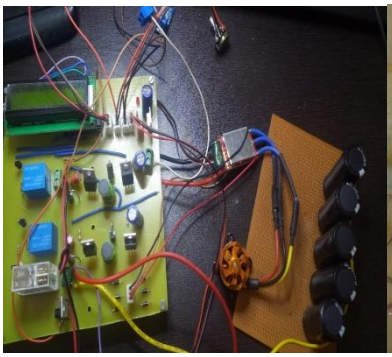
Mode 3. At the point when PV is accessible, battery is underneath its ostensible voltage and UC is over its ostensible voltage. In this mode, the UC can be used to keep up the DC interface as battery isn't skilled. Amid this task, the battery gets charged by the sun based PV. UC and battery are utilized for giving quickening power at a slower rate, as UC is presently occupied with controlling the DC interface voltage. Amid the regenerative mode, battery assimilates additional power and gets charged. Sadly, with slower reaction of the battery, it isn't conceivable to suit all the recovered vitality in a flash. Thus mechanical braking is basic in this mode to deal with the additional power.

TABLE I Results in Operations

MODE	Battery Buck-boost	SC Buck-boost	BT Relay	SC Relay	SC REG Relay	BT Volts	SC Volts	PV Volts	Accel/De-Accel	DC Load Link
1	Off	Off	Off	Off	Off	>11.4	>9	X	X	BT
	Off	Off	Off	Off	Off	>11.4	>9	X	X	BT
2	Off	Buck	Off	Off	Off	>11.4	<9	>12	X	BT
	Off	Boost	Off	Off	Off	>11.4	<9	<12	Accel	BT
	Off	Off	Off	Off	On	>11.4	<9	X	De-Accel	BT
3	Buck	Off	On	On	Offs	<11.4	>9	>12	X	SC
	Boost	Off	On	On	Off	<11.4	>9	<12	X	SC

TABLE II Parameters of the System in Test

Battery	Rated Capacity	7.5(A.h)
	Rated Voltage	12(V)
	Maximum Current	1.5(A)
Super Capacitor bank	Capacitance	100(F)
	Rated Voltage	2.7(V)
	No of Supercapacitors	5 No.s
DC Bus	Voltage	12(V)
Solar Panel	Rated Voltage	12(V)
	Wattage	40(W)



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VI. CONCLUSION

This paper presents mix of PV source with capacity gadgets like battery and UC. UC enhances the framework execution by contributing burst of intensity amid vehicle increasing speed and engrossing the recovered vitality while deaccelerating. This aides in decreasing the battery measure. Consideration of PV source expands the range that the vehicle can travel. Advancement and execution of discrete and proficient current and voltage circles have brought about more compelling control prompting enhanced unique reaction of the framework.

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BIOGRAPHIES

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