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Fast Charging of Electric Vehicle

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Abstract - as we seen a development of electric vehicle is a new era of green transportation and also need a support to build a good charging infrastructure. Generally charging mechanism will be provide in to areas i.e. residential and public .As a number of electric vehicles increased we have to increase the public charging stations also, and one major challenge is we have t reduce the charging time of electric vehicle which can be done by increasing the power transfer rate. In this paper we have seen that combination of battery and ultra-capacitor has led to reduce the charging time of electric vehicle. Lithium ion battery and electric double-layer ultra-capacitor is most suitable for doing a fast charging of electric vehicles.

Key Words: Electric vehicle, Fast charging, Charging time, Lithium ion, ultra-capacitor.

1. INTRODUCTION

Due to global warming issue the perspective of public transportation has changed to the greener system. Now days the air pollution of a India has increased drastically. We try to control and India is moving step towards it. Also to the fossil fuel depletion India has changed internal combustion vehicle to the electric operated vehicles. Generally the electric operated vehicles has not only comes under batteries but also using other power sources like as hybrid electric vehicles (HEV)

Mainly the electric vehicles charging have to areas residential charging and public charging. The residential charging means we can charge the electric vehicle in a home. This charging infrastructure is safe and reliable. Also the pubic charging area means there are the charging stations so you can go directly and charge the electric vehicle. As a increasing demand of ev we have work on charging infrastructure of electric vehicle .In this paper we discussed about how we can charge the electric vehicle as fast as possible and give reliable operation to electric vehicle.

CHARGING MODE IN EV'S

Generally electric vehicle charging is stated on two basics mode which has slow charging and fast charging. However in many regions charging station has started to classified in four modes based on its electric characteristics, charging period and charging activity method

Based on charging activity there are two types of methods on board method and off-board method. On mode charging method conducted charging inside the electric vehicles where off-board charging method required the external charger to charge the electric vehicle energy storage system (ESS).

Based on the location, the charging can done in residential area (level 1), public area (level 2) and typical area's like highway(level 3).

The level 1 means the residential area has operated on single phase 230Vac supply which required almost 6-7 hours to charged full. In public area (level 2) charging stations are build which operated on single phase and three phases 230Vac and 440Vac which required 4-5 hours to charge the electric vehicle. The typical areas will also have operated on three

phase supply and give almost same time as public area to charge electric vehicle.

Charging standards

The charging standard are classified into three levels I.e. level1,level 2 and DC fast charging.

Level 1 has comes under residential area means we can charge the electric vehicles by home. Level 1 operated at single phase 120V ac supply which has maximum current is 16 ampere.

Level 2 has also comes under residential area which operated at single phase 230v ac supply and level 3 has DC fast charging will operated on a DC supply 300-500 V.

PROBLEM DEFINATION

In electric vehicles industry, we studied that the most of the time spend on the charging of electric vehicle batteries. So due to that reason many of peoples do not happy to buy electric operated vehicles.

TECHNICAL SOLUTION

We have designed the charger which can charge the electric vehicle fast and safely. By using the combination of batteries and ultra-capacitor we can charge the electric vehicle fast.

BLOCK DIAGRAM OF CHARGER

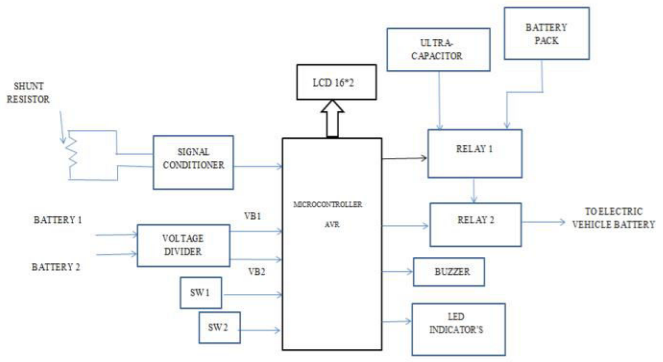

Fig1 -block diagram of charger

COMPONANTS OF CHARGER

BATTERY

A battery is storage device which can control chemical energy into electrical energy. Now days many types of the battery available in the market, mostly used battery in India now days is lead acid battery, because of its cost. The cheapest battery available in market is lead acid battery. But the disadvantages of this battery are heavy weight and it is not environmental friendly. The specific energy should be 35-40Wh/kg, Energy density is 80-90Wh/L and specific power is 180W/kg and its charge-discharge efficiency is between 50-95%. []

Also in market the nickel based batteries are available but this batteries has own advantages and disadvantages. The first nickel based battery is Nickel-Zinc battery, this battery is more environmental friendly but the life cycle of this battery is short. The Nickel-Iron battery is heavy in weight and its maintenance and self-discharge rate is high.

The battery which is suitable to fulfill the project goal is lithium ion battery. Lithium ion battery used has 3.7v voltage and 2600mAh current capacity and 9.62wh power capacity (no for one cell)Lithium ion battery has light in weight, high specific energy ,high energy density and high specific power. also the lithium battery do not have poisonous metals. The disadvantage of battery is high production cast and its required protection circuit in order to maintain safe operation.

ULTRA-CAPACITOR

Ultra-capacitor is also known as super capacitor, the difference between capacitor and ultra-capacitor is ultra-capacitor has a high capacitance (approx 20times) than normal capacitor.

There are generally three types of the ultra-capacitor i.e Pseudo-capacitors, Hybrid capacitors and Electric double-layer capacitor (EDLC).The difference between those ultra-capacitor is the material used for electrodes. The specific density for these three ultra-capacitor is almost similar around 1000-2000 KW/kg for 95% efficient pulse the EDLC has more power density than other two ultra-capacitor.

In this project we used a Electric double layer capacitor(EDLC) which has activated carbon material the specific energy is 5-7wh/kg and power density is 1-3Kw/kg and efficiency is almost about the 90%[]

BMS (Battery Management System)

Battery management system is electronic system that is used to operate battery in safe region, monitoring its state, calculating secondary data, reporting that data, controlling its environment.

The primary function of the BMS is as follows 1.safety-The time of charging there is possible to heat up battery and chances to fire so BMS continues monitoring the temp and other elements to operate is safe condition.2-sensing electric isolation-In charging time it possible of shock so BMS prevent from them by sensing electric isolation.3-communication-BMS communicates between the charger and electric vehicle to start and stop charging process.

DC-DC CONVERTER

DC-DC converter is an electric circuit which converts source of direct current from one level to another level. According to voltage level DC-DC converter has two types bulk converter and boost converter. Bulk converter has converter which step down the voltage from input to output and boost converter is converter which step-up the voltage from input to output.

MICRO-CONTROLLER

The micro-controller which used is AVR controller. It is 8-bit controller. There are 40 pins and 32 I/O pins. The micro-controller has high performance. The operating voltage is 2.7V-5.5V for ATmega16L and 4.5V-5.5V for ATmega16.

RELAY

In the project we have used to relays I.e. relay 1 and relay 2.Relay 1 is connected with ultra-capacitor and battery pack. Relay 2 is connected to the output means to the electric vehicle battery. This relays are controlled by the AVR micro-controller.

The relay generally used for the project RW/RWH which are thermal overload relay. For nominal load, contact capacity RW 12A at 120VAC, 10A at120VAC and 10A at 24VDC,also the rated carrying current and max. Allowable power force is 10A and 1500VA, 240W resp. For RWH the rated carrying current and max allowable power force is 15A and 1800 VA,360W resp.

The contact resistance is 100mohm at 1A, 6vDC and operating time id 10mSec.max and release time is 5mSec max.

SIGNAL CONDITIONER

The function of the signal conditioner is to pick up the signal and convert into the higher level of electric signal. The signal comes from resistor is in term of ohm and convert to in the form of electric current and give this signal to ADS of the micro-controller.

VOLTAGE DIVIDER

Voltage divider is a circuit which converts large voltage to small voltage. There are two voltages VB1 means voltage from supply and VB2 means voltage from the electric vehicle battery and this two voltages give to controller.

SWITCHES

There are 2 switches switch 1 and switch 2.The switches are used to start and stop the charging of electric vehicle If we press switch 1 then charger will charge the electric vehicle and if we press switch 2 then it will stop the charging of electric vehicle.

BUZZER AND LED INDICATOR

Buzzer is used where if we press the either switch 1 or switch 2 the buzzer get sounded.

Generally we used two types of LED indicator I.e red and green. The green indicator blinked throughout the charging process. Red indicator should on if we start the charging and off if we stop the charging of electric vehicle.

WORKING OF CHARGER

The AVR controller is used which is 8 bit controller. also there are 2 relays namely relay 1 and relay 2,relay 1 is connected with the ultra-capacitor and battery pack. Relay 2 is connected to electric vehicle battery. There are switch 1 and switch 2,switch 1 is to start and switch 2 is to stop the

charging. We connect a shunt resistor series with the electric vehicle battery which values is 6.8 ohm is used to sense the current. Also to calculate the bill of charging vehicle we sense two voltages, one is the voltage coming from source battery and another is from electric vehicle battery and this value is given to the micro-controller though voltage divider.

If the electric vehicle is comes to charge then we have to press switch then the battery and ultra-capacitor voltage get to the relay 1 and it passes through relay 2 to electric vehicle battery. As we connect the shunt resistor series with the electric vehicle battery to sense the electric current flow through battery and voltage will generated. This voltage get signal conditioning and output will give to the ADC of micro-controller. ADC will convert analog input to the Digital output and display electric current on LCD 16*2.Also the two voltages are given to voltage divider voltage 1 is coming from source and voltage 2 is coming through charge battery. This voltage divider converts large voltage to small voltage and give AVR micro-controller. after the fully charged electric vehicle we press the switch 2 then by calculating the values to give a bill to electric driver, we find out by formula W=V*I and then charge=ampere per sec again this current per sec converted to AH, we set the value in rs then it will calculate the bill of the electric vehicle charging and display on the LCD.

EXPECTED RESULT

We tried to make electric charger to charge the electric vehicle fast and safely. Generally the charging time required to charge electric vehicle is almost 7-8 hours for lead acid battery vehicle and 4-5 hours for lithium ion battery operated vehicles.

From this charger we can charge the electric vehicle by combining the battery and ultra-capacitor so time required for charge electric vehicle is approx. 3 hours. We are used to total safety equipment's to avoid any accident and battery will charge in safe condition.

CONCLUSION

In this paper we detailed study about the charger of electric vehicle. By using the combination of the battery and ultra-capacitor how we can charge the electric vehicle has seen in the paper.

REFERANCES

1. M. o. London, "London's Electric Vehicle Infrastructure Strategy," ed. London.
2. M. o. London, "London - An Electric Vehicle Delivery Plan for London," ed. London.
3. S. F. Tie and C. W. Tan, "A review of energy sources and energy management system in electric vehicles," Renewable and Sustainable Energy Reviews, vol. 20, pp. 82-102,
4.] EPRI and NRDC, "Environmental Assessment of Plug-In Hybrid Electric Vehicles. Volume 1: Nationwide Greenhouse Gas Emissions,"
5. CEM, et al., Global EV Outlook - Understanding the Electric Vehicle Landscape to 2020: International Energy Agency (IEA) and the Electric Vehicles Initiative of the Clean Energy Ministerial (EVI),
6. A. Burke, "Ultracapacitor Technologies and Application in Hybrid and Electric Vehicles," International Journal of Energy Research, vol. 34, pp. 133–151.
7. A Rapid Charging Station with an Ultracapacitor Energy Storage System for Plug-In Electrical Vehicles Junseok Song1 , Amir Toliyat1 , Dave Tuttle1 , and Alexis Kwasinski1 1 Departement of Electrical and Computer Engineering, The University of Texas at Austin, USA IEEE
8. 2nd International Conference on Sustainable Energy Engineering and Application, ICSEEA 2014 Energy storage system using battery and ultracapacitor on mobile charging station for electric vehicle Tinton Dwi Atmajaa,*, Amina

9. WWW.fairchildsemi.com
WWW.ti.com