

## Smart Charging Station for Electric Vehicles

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**Abstract** - *this paper deals about Electric vehicles charging station and describes a simple model of the charging station. Electric vehicle is a modern technology for reducing fuel consumption. The electric vehicles use various types of batteries. This paper describes the charging of the lithium ion battery circuits. The batteries can be charged by the AC mains supply as well as from the other DC batteries. A methodology and principle of operation are devised for charging circuit and a feasible design is modelled accordingly. This model can be implemented at the industry level by adding some safety measures. The prototype is simulated for 9V and 5V output with input of 12V AC on Proteus. The batteries in the electric vehicles are connected in series and parallel manner. The charging time of the electric vehicles depends on the current.*

**Key Words:** Electrical Vehicle, Electrical vehicle indicting station, Lithium Ion battery charger.

### 1. INTRODUCTION

Electric vehicles are the major talking point in the current era. Today there are many electric vehicles running across the world successfully and the number is going to increase rapidly in the year 2020. The figure of electric vans on the all God's creatures roads is set to triple by the culmination of the span and under current national policies may soar to as many as 125 m by 2030, conferring to the International to design and develop the charging stations for the electric vehicles accordingly.

EVs are classified into three major categories by their fuel consumption technology: hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and battery electric vehicles (BEVs). Mutually PHEVs to BEVs are also stated to as plug-in electric vehicles (PEVs), in the meantime they are considered to be rejuvenated by persisting into the command grid.

The Hybrid electric vehicles have two sources of power. One is battery and the other can be petrol, diesel, gas etc. These are further classified into different types.

The Battery electric vehicles Is the pure electric vehicle. The battery in these electric vehicles is charged from the main supply. They have only one power source. These have limited range as they have one source of power.

Considering of a vehicle the most important question is about the fuel. The electric vehicle run on a source which can be produced by the human beings unlike other non-renewable sources. As the non-renewable sources of energy like petrol will go on depleting, the demand for electric vehicles will go on increasing. Industry. Since battery is a commonly used device for storage of energy, calculation of Status of Charge plays a vital role in the future [1]. There are different types of batteries used in these electric vehicles. Some batteries are Lead Acid batteries and Nickel Metal hydride batteries. Both lead acid batteries and nickel metal hydride (NiMH) batteries are mature battery technologies. These categories of sequences re in premweature rechargeable vehicles such as All-purpose Motor's EV1

But, they are now well-thought-out to be outmoded with favors to their habits as the core font of energy packing in BEVs. Lead acid successions have seen castoff in straight petroleum obsessed vehicles and are quite inexpensive.

Lithium ion (Li-ion) sets are now painstaking be the typical for up-to-date battery electric vehicles. There are many forms of Li-ion sequences that each drink different physical appearance, but vehicle productions are concentrated modifications that have superb endurance. Equaled to other mature mobile tools, Li-ion offers various reimbursements. For case, it has admirable specific energy too energy bulk, making it superlative for free style electric vans [2]. The lithium ion runs backing the ear of fast charging distinct the lead acid sequences which get hurt when exasperated to control fast. This elasticities lithium ion successions an authority over lead acid successions. Still there are some rechargeable reduced amount of expensive than the lithium ion batteries.

The recent electric van charging postings only hold 3 Phase AC supply. The postings only afford the three phase stream as it styles general station for different forms of electric vehicles. These classes have shrewd hoard posting which tell adjacent the error, End of arraigining, and buff. The rest of the route to alter the AC into DC to governor the batteries is exclusive the vehicle.

This typical is currently instigated in the Electric vans for buses. These vans are at present running. They approximately take 3 hours to charge in normal blaming mode. The contemporary ranking of these buses is approximately 126A. In a on its own charge they run about 200Km depending on the temperature.

Added type of rechargeable bike eat lead acid sequences as font. These buses use a unpretentious charger for evaluation of these successions is 48V and for another distinction the mobile voltage is 60V. These sequences can be thrilling in houses as they require regular 230V AC coupled in series to make up 48V. These batteries take about 6 hours to charge and run about 60Km in a single charge.

## 2. RELATED WORK

Representative Freestyle pony mainly comprises of two points: AC to DC stage using boost or interwove boost converter where authority feature modification is taken care by engaging suitable control practice andt furthering current level to an separating dc bus near. The next stage is DC/DC stage someplace the current is structured bestowing to the freestyle prerequisite [3]. One thing boons a reasonable study of the act of two categories of battery mares being settled for electric vans. *The first mare is a microprocessor* constructed ferroresonant battery steed, talk about to as the ferroresonant mare. The command carriage section of this stallion is a ferroresonant converter, *which exploits the satiety of hypnotic materials* from side to side its capacitor curving to goods a well-regulated crop that be like a square wave. The control slice periodically residences a resistive load across the mobile under trust that countenances this change in struggle to be detected. Analyzes data from the battery charge monitor circuit. The

monitor circuit measures the voltage bead across the battery, which is personal to the battery inside fighting when the shipment is introduced [4].

A paper on “An Summary of the Details of Battery Chargers” [5] dowries an summary of the essentials of free style mares, excluding charging processes and circuit carrying out of rectilinear and transferring battery ponies. First, the basic job of runs is described lower than open journey, discharging, and charging environments. Next, an synopsis of the pulse alleging outline also its execution is offered, tailed by an summary of the Constant-Current Constant Voltage (CCCV) incriminating outline and the special contemplations pertaining to alleging Lithium Ion (Li-Ion) batteries.

There are quite a few techniques used in the predictable approach to arraigining a battery. The first and the utmost common in purchaser foods is the constant current flood charge. These ponies provide a very low, perpetual present-day rate to the free style and rely on user interpolation to stop the burden when the battery has resumed to full ability [6].

## 3. EXPERIMENTATION

### Components Used

- Transformer- 230/12 V 500 mA
- Diodes 1N4007
- Voltagerregulator IC's 7805 and 7809
- Lithium ion batteries- 3.7V 160mAH.
- Arduino Uno
- LCD Display 16 x 2
- Capacitors
- LED
- Jumper wires

### Circuit

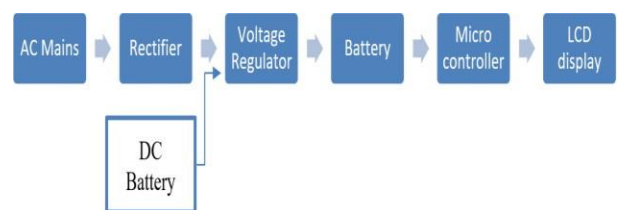


Figure 1: Block Diagram

The battery can be charged in two ways. First directly from the AC mains supply and second from another DC battery. Both the charging circuits are described here in this paper. The actual charging of the batteries in electric vehicles is a different procedure. We do not charge a single battery but, a combination of sequences in successions and parallel are charged. The circuit describes the charging lithium ion batteries. There are total four lithium ion batteries each of 3.7 volts. Double of them are related in corresponding and other dualistic sequences are connected in analogous and are in succession with the prior parallel connection. Thus the maximum voltage obtained with this combination is 7.4 volts. The batteries have a current rating of 100mA. The transformer used is a 230V to 12V transformer with a current rating of 500mA. There are two power supply circuits built. One to charge only the parallel combination of 3.7V and the other circuit to charge the four batteries in series parallel combination of 7.4 volts.

The circuit starts with the supply from the AC mains the 230v Ac mains supply is given to the transformer. The transformer is a step down transformer which steps it down to the 12V. The 12V supply is then given to the power supply circuit. The power supply circuit as mentioned above are two. One which provides 9V power and other which gives 5V power. There should be different power supply circuits as we have to charge batteries with different voltages. This type of circuit gives us a freedom to charge as many batteries in different series parallel combination.

Here in the Proteus we have directly given 12V input. The circuit then works fine. In reality, we take input from AC mains or a DC 12V battery.

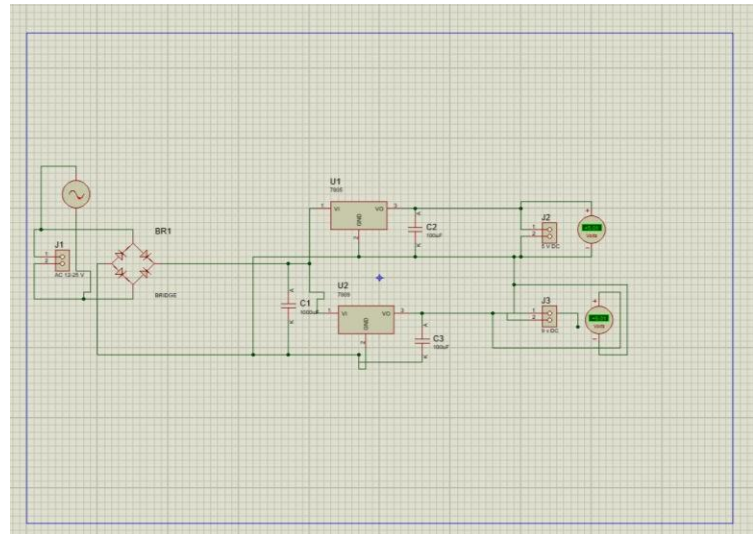


Figure 2: Circuit Diagram of power supply

The different components in the power supply circuits are diodes, capacitor, and Voltage regulator, capacitors. The two different capacitors are used in order to filter out the noise. During the conversion from 230V to 12V there may be a greater noise margin hence, a capacitor of larger value is fed there. At the output too there is another small capacitor. The same power supply circuit is used in two ways. One by using IC 7805 which is a 5v regulator IC and the other is by using 7809 which is a 9V regulator IC.

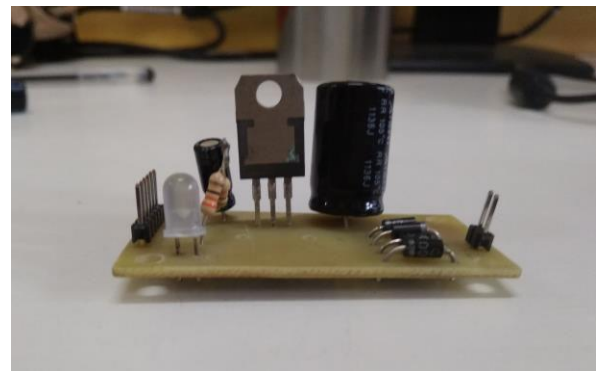


Figure 3: 5 V Power Supply

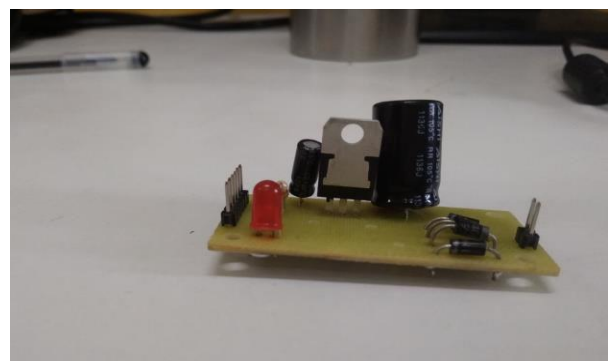


Figure 4: 9V Power Supply

The output from the power supply circuits is given further to the other point. At this juncture two diodes are placed in order to globule down the voltage. Ideally the drop across diode is 0.7V but, practically it is 0.4V here. There are total two diodes connected at other diode ensures there is no backward flow of current.

The two diodes are connected in forward biased and reverse biased mode. The forward biased one ensures flow from AC mains to battery and reverse biased one ensures one way flow. Thus, the basic circuit is completed here. Now to cutoff the circuit after the charging circuit is done there is use of controller which monitors the battery voltage and when it exceeds above a certain value cut offs the circuit from the charger. The controller directly switches off the relay and then the batteries are cut off from the charging circuit. Another thing here is that the voltage of battery exceeds 9V hence, it cannot be directly given to the Arduino Uno directly as the maximum voltage for Arduino is 5V. Hence, here we use a voltage divider circuit which maps the 9V to 5V and then it is given to the Arduino.

Instead of using the AC mains supply we can use directly a DC battery as a supply. This battery should be greater than 9V as we are designing a supply of 9V. The rest of the circuit remains the same only the AC mains is replaced directly by a DC battery.

#### 4. CHARGING DETAILS

The charging time of the circuit depends on the current. Here we have used a transformer with a rating of 12V and 500mA. Here the current rating of the lithium ion batteries is 100mA. Thus in max if we connect the four batteries n series the current will be 400mA. Thus we have used here the maximum fastest and safest current possible. Thus the charging will be fast and safe. The input current to the batteries decides the charging time. We cannot increase the input current to the batteries beyond a certain limit. Suppose the output from the transformer is 100mA then, it would take almost four times the time it would have taken for 400mA output.

The discharging time of the lithium ion batteries is also dependent on temperature. As the disease growths the free style tend to emancipation more soon. The battery does not completely discharge. The arrainging time is planned by watching the voltage points of the battery on or after its highest point to lowest point and mapping time accordingly. Thus here we calculate charging time by voltage change in battery.

#### 5. CONCLUSIONS

The lithium ion batteries can be charged with the help of mentioned circuits and these type of circuits tin can be castoff to create a battery charger for electric vehicles.

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