

# A Review on Battery Management System for Electric Vehicle

Shubhangi M Gond<sup>1</sup>, Amol D Bhoi<sup>2</sup>

P.G. Student, Department of Electronics and Telecommunication, G.H. Rasoni Institute of Engineering and Technology, Pune, India<sup>1</sup>

Professor, Department of Electronics and Telecommunication, G.H. Rasoni Institute of Engineering and Technology, Pune, India<sup>2</sup>

**ABSTRACT:** The basic difference between humans and animal is humans have developed brain. Human brains are intelligent system which helps to observe, study, understand and take decision. Similarly, for battery vehicle Battery Management system is nothing but the brain only it observed, monitor, study, compare, and take decision. In case of E vehicle intelligent or developed battery, management system reduces 50% to 70% human's effort with increasing in accuracy without making any human error.

New battery models improve by combining elements of conventional static battery management techniques with adaptive, dynamic elements drawn from neural networks. This neural network reduces the need for empirically derived constants, offering dynamic solutions for battery management. The algorithms used for estimation of state of charge are compared by the error rates achieved.

**KEYWORDS:** Battery, Fuel, charging, Neural Network, Temperature, Automotive, BMS, Sensor.

## I. INTRODUCTION

Basic automotive says engine drives vehicle by generating power. To generate this power engine need fuel. Imagine a vehicle without fuel is nothing but the piece of iron. Fuel sources are limited in availability one day it will be exhausted. Looking at current demand and supply of fuel we will face these days sooner. Fundamental of finance is the more demand limited source causes high cost we also experience same. Current oil prices are very high. When this fuel gets burn in engine vehicle left (CO<sub>2</sub>) emission in environment directly. This emission has lots of side effect it contributes to global warming also it is affected on Human body names are few. Those three are major reason now complete automotive manufacturer looking for second energy source for fuel energy. Modern automotive consider so many energy sources for substitute to fuel like solar, steam, battery etc. out of all with number of studies by automotive scientist it is convinced that battery vehicle have potential to become successful substitute for fuel vehicle with lots of advantages over conventional fuel vehicle. In last few years if we see the development in mobile devices like Laptop, mobile etc. initial days of mobile had battery with very less life. We need to charge phone within small time interval. After utilizing mobile for few years many people face problem like battery drain very fast. In those days we observe our mobile device no more mobile. Because we observe mobile become landline, major time we will observe it is connected to charging cables. Similar case with laptop also after utilizing for few years our laptop was not working without connected to cable. Now with development in battery management system you will find our mobile devices are not only long lasting but also compact with high battery life. In automotive industry, as we understand and referred from the study of automotive scientist that battery vehicle has that potential to become substitute for conventional fuel vehicle and it is not only a development for automotive industry it is basic need of future same like bread and butter. So, in current time we are having develop, compact, cost effective battery with combination of intelligent battery monitoring and management system E vehicle will become 100% full proof invention for human beings. A develop battery with intelligent battery monitoring and management system can helps to improve efficiency of E vehicle with also reducing human errors.

## II. PROBLEM STATEMENT

Modern automotive face lots of challenges, out of all big challenge is "global energy prices". cost of fossil oil increases rapidly. Hence industries demand substitute for gasoline. E vehicle is new successful invention over conventional fuel vehicle. Invention consists lots of small invention and sub systems. Those sub systems also need

to improve to become a new big invention. This is we called a journey from good to best. BMS system plays same role in E vehicle. BMS monitor and manage battery parameters that parameters provide forecast. This forecast helpful to avoid major crisis happens in future.

### III. LITERATURE SURVEY

Energy resource for conventional vehicle like gasoline is limited in availability, as we aware limited source with high demand causes high cost. Many studies conclude that reserves of oil, coal and natural gas could be exhausted within the next 200 years. Hence modern automotive research for reusable energy sources like E Vehicle. The second and equal important need for E vehicle and battery management system is CO<sub>2</sub> emission form conventional vehicle. The drawback of using conventional vehicle and its emission are not unavoidable which contribute to Global warming. The presence of excess carbon dioxide in the atmosphere has been attributed to a rise in global temperatures, rise in sea levels, negative impacts on natural ecosystems and a rise in catastrophic weather events. Many scientists concluded that Battery vehicle produces very less emission compared to conventional gasoline powered Internal combustion engine. Even if we consider electricity which is used to power to battery vehicle is produces from coal. The scientist also concluded the renewable energy resources like wind, solar, Battery etc. are produces approx. zero to no emission. Hence the question raises why the industry is not dominated by battery vehicle.

### IV. PROPOSED SOLUTION

As stated, the whole implementation would be done using Neural network algorithm which will be implemented on MATLAB software for the process.

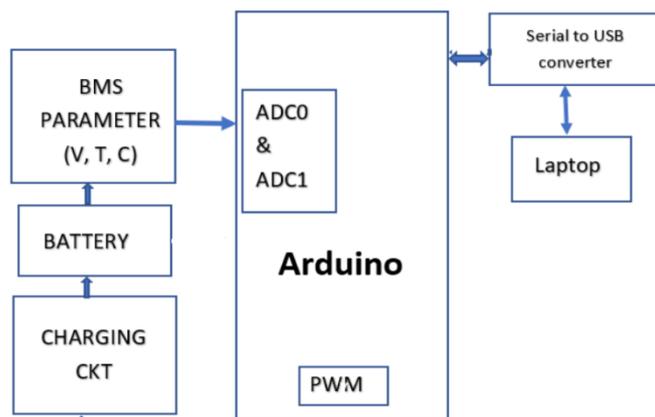


Fig1: BMSBlock Diagram

To process all this Parameter used Arduino along with other peripherals. like power supply, temperature sensor, battery, signal conditioning circuit, etc. Hence, the solution is basically divided into two parts: first part includes Parameter processing is done using sensor & produce decisions, and second part implements the decision received from first part through MATLAB software using Neural network algorithm.

#### A. Arduino Uno (ATmega328P)

Arduino Uno is a microcontroller board based on the AT mega328processed. The Uno board is the first in a series of USB Arduino boards. Arduino can connect to computer with the help of USB otherwise Arduino can connect with AC-to-DC adapter or Arduino can directly connect battery to getting start. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.

#### B. Temperature Sensor (Precision Centigrade)

The output of precision integrated-circuit temperature sensors is linearly proportional to the Degree Celsius (° C) temperature user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling is biggest advantage over linear temperature sensors calibrated in° Kelvin.

**C. BMS Function**

**a. Charging/Discharging control:** BMS will charge battery in constant voltage mode. rate of Discharge of battery is controlled using fast PWM signal. Arduino will send battery SOC to MATLAB and neural network will decide PWM duty and it will send back to Arduino to control PWM controlling MOSFET current.

**b. SOC:** Refer following table which shows SOC of battery by "open circuit voltage" method. As per measured voltage of battery, Arduino will communicate SOC % to MATLAB

Charge	Voltage Table - Li-ion Rechargeable Battery						
	3.6V(1S)	7.2V(2S)	10.8V(3S)	14.4V(4S)	18V(5S)	21.6V(6S)	25.2V(7S)
0%	3.31	6.62	9.93	13.24	16.55	19.86	23.17
5%	3.69	7.38	11.04	14.72	18.4	22.08	25.76
10%	3.69	7.38	11.07	14.76	18.45	22.14	25.83
15%	3.71	7.42	11.13	14.84	18.55	22.26	25.97
20%	3.74	7.48	11.22	14.96	18.7	22.44	26.18
25%	3.76	7.52	11.28	15.04	18.8	22.56	26.32
30%	3.78	7.56	11.34	15.12	18.9	22.68	26.46
35%	3.78	7.56	11.34	15.12	18.9	22.68	26.46
40%	3.79	7.58	11.37	15.16	18.96	22.74	26.53
45%	3.81	7.62	11.43	15.24	19.05	22.86	26.67
50%	3.82	7.64	11.46	15.28	19.1	22.92	26.74
55%	3.84	7.68	11.52	15.36	19.2	23.04	26.88
60%	3.88	7.76	11.64	15.52	19.4	23.28	27.16
65%	3.92	7.84	11.76	15.68	19.6	23.52	27.44
70%	3.95	7.9	11.85	15.8	19.75	23.7	27.65
75%	3.98	7.96	11.94	15.92	19.9	23.88	27.86
80%	4	8	12	16	20	24	28
85%	4.05	8.1	12.15	16.2	20.25	24.3	28.35
90%	4.09	8.18	12.27	16.36	20.46	24.54	28.63
95%	4.13	8.26	12.39	16.52	20.65	24.78	28.91
100%	4.18	8.36	12.54	16.72	20.9	25.08	29.26

Table 1: SOC of battery

**c. Temperature measurement:** Temperature measurement and its control by limiting charging of battery. temperature of battery will be measured with LM35 sensor and its value is sent by Arduino to MATLAB. Using SOC value and temperature both, PWM duty will be decided by MATLAB.

**d. Low power consumption:** Low power consumption - about 1% of that of load for EV Arduino can be optionally configured into low power mode to reduce online power consumption when battery is not in active charging or discharging operations

**V. SOFTWARE REQUIREMENT**

**A. Arduino compiler**

BMS parameter communicate with Arduino by using its unique pins. It receives and transmit data for execution. Advantage of Arduino compiler is used with any Arduino board. It runs on Windows, Mac OS X, and Linux. With the help (IDE) it become user-friendly to writing code and also to upload to board.

**B. Neural Network**

To implement real time output MATLAB is used. BMS parameters operating condition identify using Neural network algorithm will be implemented on MATLAB software for the process processors. The neural networks concept is part of intelligence, which is come to light and getting huge demand in the development of systems. Neural network recognize change in input, so network gives best possible result, due to this no need to redesign the output criteria.

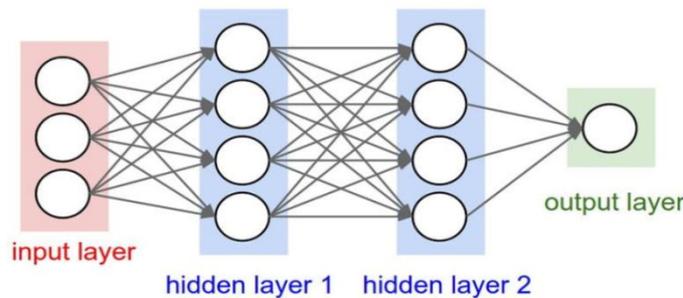


FIG 2: NEURAL NETWORK

Each neural net accepts knowing "Input" and generate probability forming result weighted associations between the two, get stored data structure of the net within it.

## VI. RESULT

We would be getting real time value of Temperature, voltage & SOC parameter of BMS system.

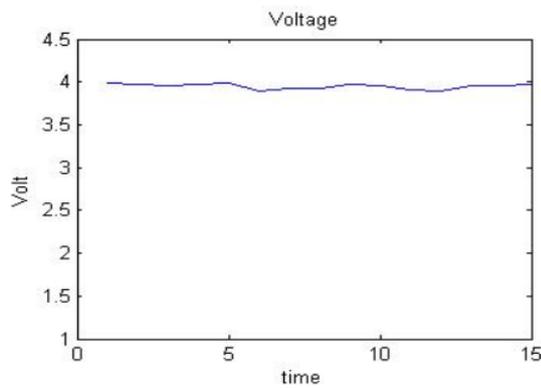


Fig 3: Real Time Voltage Parameter

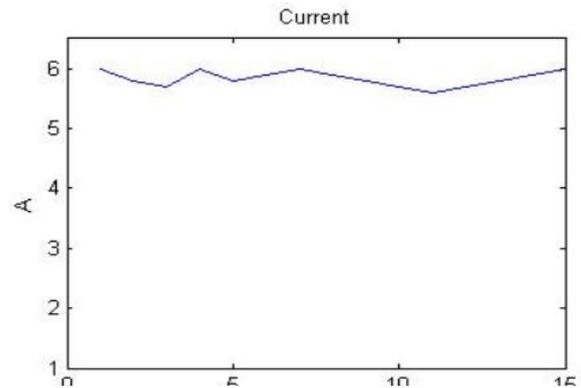


Fig 4: Real Time current value

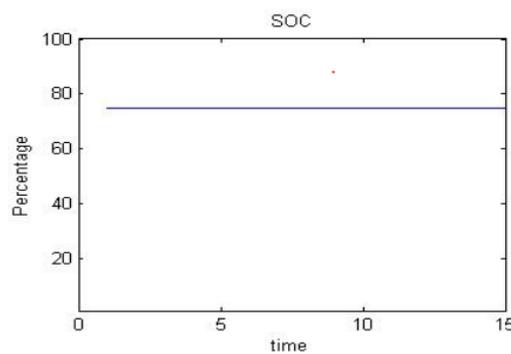


Fig 5: Real Time SOC %

## VII. CONCLUSION

The paper presented can conclude following points

- Brief idea about evaluation of E-vehicle.
- Need of AI (Neural Network) system for E-vehicle.
- Introduce BMS for value addition result & output.

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