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Battery Temperature Control with Tempreature Monitoring System

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Introduction

Now a days there is widely increasing demand for electric vehicle so for electric vehicles the batteries are the important part on which the vehicles work or operate. In various studies show us that due to high temperature of batteries. It affect the performance and lifetime of batteries. If battery temperature is higher than the temperature of environment where is located then it can lose heat due to conduction, convection and radiation . every 8C rise in temperature, a seal lead acid battery loses half of its lifetime and the heat damaged your battery. Also, fault in a battery is attached to circuit can negatively impact on its temperature. As well as if the environmental temperature is higher than the internal temperature of battery then it will get heat. Battery temperature, voltage , humidity monitoring can detect these faults and alert in timely manner before the problem occurs in the system .The battery health temperature monitoring system is to keep an eye on your battery's voltage , humidity and temperature.

Overview

Battery consist of two terminals which are cathode which positive terminal and anode which is a negative terminal. The electrodes are immersed in an electrolyte. The chemical reactions which takes place inside the system which is called as redox reaction.The batteries are of two types They are rechargeable batteries and non-rechargeable batteries. There are many types of batteries which are used for various applications some of them are lead-acid battery, lithium-ion battery, nickel-cadmium, fuel cell. Generally the rechargeable batteries are widely used such as lead-acid and lithium-ion battery. Their is good charge storing capability of Lithium-ion battery where as, lead-acid batteries are cheaper. Hence the lead-acid

batteries are used widely. Battery temperature, voltage , humidity monitoring can detect these faults and alert in timely manner before the problem occurs in the system. Battery plays a main role in various power systems, electric vehicles, power station etc..

The battery health monitoring system is to keep an eye on your battery temperature, voltage, humidity**.**

Objective

There are various elements that battery monitoring system should provide you actionable information about your network:

- Proactive and knowledge based maintenance services can be scheduled.
- Faulty batteries can be detected and take an action before any problem occurs.
- The batteries life will increased.
- Reduce costs with truck rolls and maintenance.

Literature Review

1. P. Aswin Sevugan, M. Pradeep, Abhishek Krishnaswamy, K Karunamurthy in November 2021 has proposed a system infront of us that the electric vehicle has low emissions and noise pollution are the most suitable alternatives for conventional vehicles. Lithium-ion batteries which are widely used in Electric Vehicles are meant to operate within a temperature range of 20 °C–50 °C Battery Thermal Management Systems plays a vital role in maintaining this temperature range,

2. Shi Jin, Qing Gao, Xue Gao, Yuan gao, Tianshi Zhang in april 2022 has proposed a system infront of us that the dual flow management system is more economical than refrigerant cooling. The refrigerant can be effectively cool the battery by evaporating with poor economy.

3. Hao-dong Wang, Qing Gao in october 2021 has proposed a system infront of us that there is rapid development in electric vehicles because of that the thermal safety of power batteries has received much attention. This system is manifold-based thermal management system that sprays regrigerant on to the surface of overheated batteries to prevent the occurance of thermal runway.

4. L Li, J Tian in 13 october 2018 proposed a system infront of us, to ensure the driving safety and avoid potential failures for electrical vehicles, evaluating the health of the battery is of great importance.

Methodology

Battery temperature monitoring and cooling system, we are using microcontroller which have a inbuilt Wi-Fi model ESP8266. Along with microcontroller, we are going to use battery packs with bms to protect the battery from discharge and overcharging .DC Voltage to read the battery voltage, DST11 Sensor to get temperature as well as humidity values of

battery, for heat exhausting we are using fan, relay use for to turn ON/OFF fan and lastly all data will be shown in LCD as well as android and Web Application through blynk server. Communication between cloud blynk server and node through ESP8266 Wi-Fi model. For programming, we are store the essays ID and password with the help of Embedded C language. This system is based on IoT technology so there is no any range limitation and multiple user can use the application with the help of Gmail ID and password for security purpose.

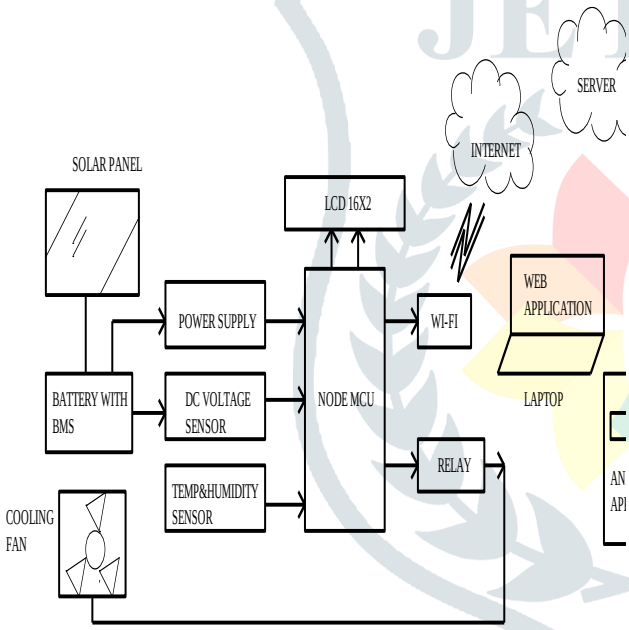


Fig 3.1 Block Diagram

Working operation

In this system, firstly we are using solar panel which will give power supply to battery packs battery backs are with bms to protect battery from overcharge and discharge we need monitor temperature and humidity of battery through DST11 sensor; output will be send to microcontroller continuously for monitoring. If the battery temperature is get high beyond the range then cooling fan will automatically turn ON through relay for cooling purpose and if the battery temperature is get low beyond the range then exhaust fan turn OFF using relay so it will save the power consumption whenever its required. At the end, all data in terms of temperature and humidity will be display on LCD as well as on application (android and web application) through communication of Blynk server and ESP8266. By which we can monitor the temperature of battery in mobile or laptop from any where so that we can prevent damage occur in battery.

Designing of Power Supply

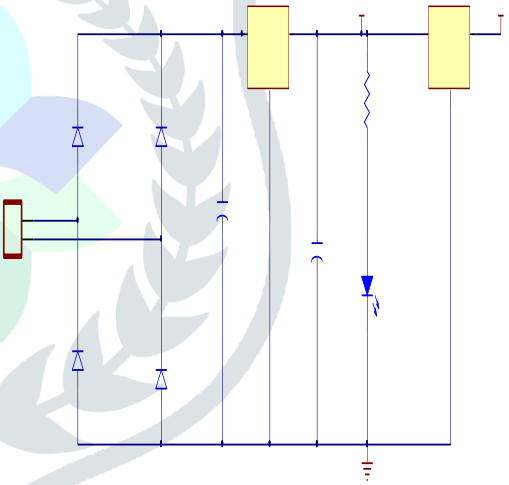


Fig 3.3 Power Supply

The information is available to the designer of the transformer.

- Power output.
- Operating voltage.
- Frequency range.
- Efficiency and regulation.

The core size is one of the first in consideration in regard of weight and volume of a transformer. This mainly depends on type of core ,winding

configuration used. Generally the formula is used to find the Area or Size of the Core.

$$Ai = \sqrt{Wp} / 0.87$$

Ai = cross section area in square cm.

The , Wp = Primary Wattage.

the 9 v is the rating of secondary winding of transformer, 500mA. Because we require 5voutput

So secondary power wattage is,

$$P2 = 9 * 500mA$$

$$= 4.5Watt$$

So,

$$Ai = \sqrt{4.5} / 0.87$$

$$= 2.43$$

Generally 10% of area should be added to the core.

So,

$$Ai = 2.673$$

a) Turns per volt :- Turns per volt transformer are given by relation.

$$\text{Turns per vlt} = 100000 / 4.44* F* Bm* Ai$$

Where,

F = Frequency in Hz.

Bm = Density in weber / sq m.

Ai = Net area of cross section.

This will give the value of turns per volt for 50 Hz frequency.

Generally lower the flux density better will be quality of transformer. For our system we have taken the turns per volt is 0.91 Wb / sq.m .

Turns per vlt = 50 / area of cross section(Ai)

$$= 50 / 2.673$$

$$= 18.7055$$

Turns for primary winding ,

$$230 * 18.7055 = 4302.265$$

And for secondary winding,

$$9 * 18.7055 = 168.3495$$

b) wire size :- As stated above the size depends on the current to be carried out by winding which depends upon current density. For the transformer one tie can safely use the current density of 3.1 Amp / sq.mm.

To decrease copper loss 1.6Amp/sq.mm or 2.4sq.mm may be used generally even size gauge of wire are used.

Root mean square(R.M.S) secondary voltage at secondary to transformer is 9V. so max. voltage Vm across secondary is

$$VP = Vrms \times \sqrt{2}$$

$$Vrms = VP / \sqrt{2}$$

$$= 9 / 1.141$$

$$= 7.88$$

D.C output voltage Vm across secondary is,

$$Vdc = 2 * 7.88/pi$$

$$= 2 * 7.88/3.14$$

$$= 5.02 V$$

P.I.V rating of each diode is

$$PIV = 2Vdc$$

$$= 2 * 5.02$$

$$= 10.04 V$$

Max. forward current which flow from each diode is 500 mA. So from the above parameters, we select the diode 1N4007 from the diode selection manual.

- Design of filter capacitor:-

Formula for calculating filter capacitor is

C =1/4 (√ 3 * r * F * R1)

r = Ripple that is present at the output of rectifier,

which is maximum 0.1 for full wave rectifier.

F = frequency of AC main.

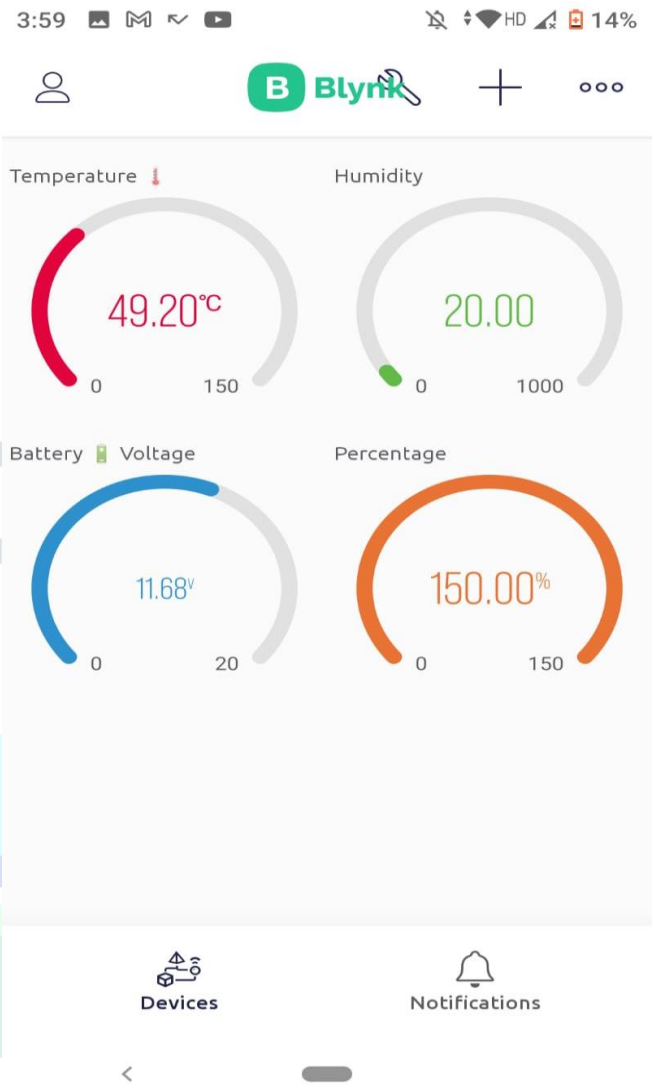
R1 = Input impedance of the voltage regulator IC.

C = 1/(4 *(√ 3 * 0.1 * 50 * 28))

= 1030 µf

= 1000 uF

The voltage rating of the filter capacitor should be greater than the i/p Vdc i.e. rectifier output which is 5.02 V so we choose 1000µf / 25V filter capacitor



Result

Images of Output of the proposed system.

Conclusion

A methodology has been planned for scheming and enhancing the battery with help of cooling fan by using relay. The cooling fan is working in this system in order to reduce temperature level of battery pack and heat exchanger.By using this system, it is perceived that the charge retentive capability of battery and period of battery. And we use LCD as well as android and Web Application through blynk server. Communication between cloud blynk server and node through ESP8266 Wi-Fi model to monitor the temperature ,humdidity, voltage of battery to prevent the fault which can occur in battery and to increase battery life.

Future Work

The approach of the substitute model further improved the structure of cooling layer.

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