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Battery Management System Using machine Learning

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Abstract: Lithium-ion batteries have proven to be interesting for electric vehicle manufacturers due to their high charge density and light weight. These batteries are packed with a lot of punch for their size, but they are inherently very unstable. It is very important that these batteries are not overcharged or under discharged in situations where voltage and current need to be monitored. This process is a bit more difficult as many cells are assembled into the battery pack of an electric vehicle and each cell needs to be monitored individually for safe and efficient operation. It requires a special system called a battery management system. To get the most out of the battery pack, all cells should be fully charged and discharged at the same voltage at the same time. This requires BMS. Apart from that, BMS is blamed on many other features described below..

Keywords: Machine Learning, Battery Management, Monitoring, Safety.

I. INTRODUCTION

Predicting battery life helps with the smooth and consistent functioning of battery-powered systems. The main goal is to design and develop an intelligent battery management system battery. The proposed system uses a hybrid machine learning (ML) algorithm to estimate battery life. Both experimental and moduling tasks to perform multiple tasks such as charge and discharge control, overcharge and over discharge protection, charge state (SOC) calculation and display, charge state (SOH), thermal management, etc. It will be executed. The proposed method combines electrical equivalent circuits with machine learning models to improve accuracy without sacrificing computational effort. Machine learning-based models may be updated and readjusted using the digital twin of the battery and flashed back to the BMS microcontroller..

II. OVERVIEW OF BATTERY MANAGEMENT SYSTEMS

Compared to other chemical types, lithium-ion batteries are used in the industry for a variety of applications, including: Than an electric car because of the unique features mentioned Introduction. Therefore, the application is very demanding. Monitoring and control methods, d. H. BMS, expand Avoid battery life and sudden catastrophic events. In order to implement BMS effectively, it needs to be implemented in various parts of BMS.

Learn more and some approaches to overcome them Defects and their outcomes also need to be improved Can be investigated. For reference lectures and research The main part of BMS. Because electric vehicles face many challenges due to battery packs Battery status should be monitored at run time under normal and abnormal conditions. Battery cell monitoring in Includes battery status and activity indicators[1].

monitoring Voltage, current, and temperature are also essential to protect the battery cell from over current and overvoltage [2], [3].

Voltage, current, temperature recording Battery cell with sensor and data acquisition system [4], [5] Can generate data to analyze consumption patterns development of electric vehicles and prediction of future state of batteries. Feature extraction and data-driven methods [6], [7].

Effective BMS can reduce the number of batteries Charging / discharging during the life cycle. Provided by PMC Various electronic devices and patents Overcoming this challenge has made it effective and is now The main topics of industrial research and automobile research. For PMC, we are proposing many electronic devices, Effective patents to solve this problem [8], [9]

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2.Vibrationsensor

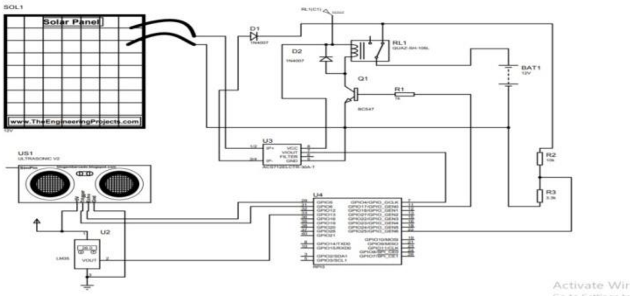

Fig-Vibration sensor

III. WHY DO WE NEED BATTERY MONITORING

A normal battery takes about 6 hours to charge and another 6 hours to discharge. The cell's voltage and current profile changes during charging and discharging, depending on load, aging, temperature, and many other conditions. It is virtually impossible to charge and discharge the battery in all the conditions required for the life of the battery pack to ensure that the BMS is functioning as expected. For this reason, a battery model was developed. This model can function as a virtual battery (hardware in a loop) during the development stage of BMS.

Thermistor

Fig. Thermistor

- Resistance at 25 degrees C: 10K +- 1%
- B-value (material constant) = 3950+- 1%
- Dissipation factor (loss-rate of energy of a mode of oscillation) δ th = (in air)approx.7.5mW/K
- Thermal cooling time constant <= (in air) 20 seconds
- Thermistor temperature range -55 °C to 125 °

Fig.Ultrasonic Level Sensor

Tank degree measurement, Fuel gauging, irrigation control. This challenge for a Low Power Water Level Sensor, from Hackster.io developer Amedee, makes use of a climate resistant sensor from our WR line. In aggregate with a LoraWan node and The Things IOT open supply network, this challenge changed into evolved to degree the water degree in a rainwater tank. Although it may be used in lots of applications.

- Power Supply: DC 5V
- Working Current: 15mA
- Working Frequency: 40Hz
- Ranging Distance : 2cm – 400cm/4m
- Resolution : 0.3 cm
- Measuring Angle: 15 degree

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- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

Current Sensor

Fig. Current Sensor

The ACS712 is a fully integrated Hall effect based linear current sensor with a low impedance current conductor integrated with 2.1kVrms voltage insulation.
Terminology aside, it's simply called a current sensor, which uses its conductor to calculate and measure the amount of current applied.

The features of ACS712 include:
80 kHz bandwidth
66 to 185 mV/A output sensitivity
Low-noise analog signal path
Device bandwidth is set via the new FILTER pin
1.2 mΩ internal conductor resistance
Total output error of 1.5% at TA = 25°C
Stable output offset voltage.

Solar Panel

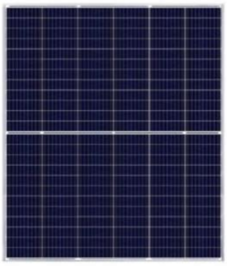

Fig.Solar Panel

The 10 watt, 12 volt solar panel will provide enough power to trickle charge a 12V vehicle or deep cycle battery. Helps run pumps, lights, fans, and small appliances such as stereos, televisions and VCR's in caravans, boats or cabins.
Specifications
- 10 watt -12 volt panel
- Poly-Crystalline

Advantages Of BMS
- 1. It Ensure that the battery is in good working order.
- 2. Battery health is continuously monitored to avoid an explosion.
- 3. Extends the battery's life expectancy.
- 4. Provide protection against battery damage.

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IV. CONCLUSION

The accuracy of SOC and SOH also depends on the accuracy of the battery model. Therefore, you should always provide high fidelity and robustness. Typical usage of the battery model. In an ideal battery model, the input voltage should be equal to the output voltage and the error value should be zero. However, in practice, many parameters such as temperature and age can affect the system, making this scenario difficult to achieve.

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