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Battery Monitoring System Using Labview

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Abstract: - In order to obtain the rated service life and the longest possible run times of a battery, it must be monitored & pro-actively maintained. The amount energy stored and used from batteries has quadrupled over the last decade. This calls for an effective battery monitoring system that can predict the life of a battery with respect to the load connected, and accounts for battery degradation over time. Therefore, we intend to create a real time battery monitoring system that will be able to provide the user with the constant state of charge of their battery, time till empty if run on current load and the degradation occurring to the battery over time as a function of its temperature, load connected. Human intervention is not required for recording the instantaneous values. To simplify this job a LabVIEW Graphical User Interface (GUI) is made to automate the battery monitoring system.

This project has a GUI which has a provision to read voltage, current and temperature of the battery while it is charging or discharging. There is a provision for the data to be recorded in the database with all voltage, current, time for charging and discharging. This helps to know the actual problem of the battery and avoids damage of it by knowing it in prior.

Key Words: — LabVIEW, Battery monitoring system.

I. Introduction

In this project different pilot experiments were carried out on rechargeable battery for various issues. To design simple and useful experiments for battery, the data acquisition system has been experimented and used for reading various parameters of the battery. The data acquisition programs are written in LabVIEW and executed successfully according to the requirement of research work. The signal conditioning circuits are required for temperature and high load measurements. This hardware is linked to the LabVIEW and both parts are tested and results are presented. The rechargeable battery has been studied for self-discharge rate so that exact estimation of remaining power would be calculated.

The battery monitoring system (BMS) is a critical and important component of electric and hybrid electric vehicles. The function of the BMS is to assurance safe and reliable battery operation. To maintain the safety and consistency of the battery, state monitoring and evaluation have been implemented in BMS. As an electrochemical product, a battery acts differently under different operational and environmental conditions. The uncertainty of a battery's performance poses a challenge to the implementation of these functions. This chapter addresses concerns for current BMS. State evaluation of a battery, including state of charge, state of health, and state of life, is a critical task for a BMS.

A. Objective

To identify the parameters of the battery which leads to the degradation using Arduino UNO interfaced with LabVIEW.

II. Existing System

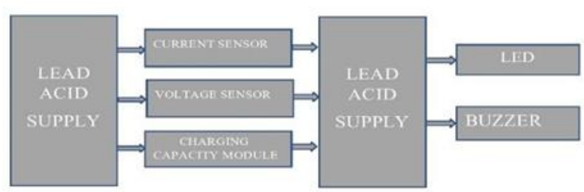


Fig.1. Block Diagram of Existing System

shown in the Fig.1. the current and voltage levels of the battery are obtained through sensors and these sensors gives these values as inputs to the ARDUINO. By depending on the output voltage of the battery, the approximate charge of the battery can be estimated. When the battery level is getting low, the led will blink, as well as it will be also displayed in LCD and also send message to the particular person using internet of things.

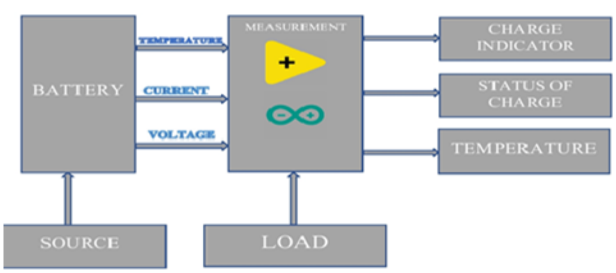
A. Disadvantages in Existing System

The main problem in this system is that it shows only the voltage and current levels and nothing about the other parameters.

III. PROPOSED SYSTEM

The battery monitoring system of the electrical vehicle ensures that whether the battery is being charged or discharged. Committed electronic systems are installed in the devices for safety, convenience, comfort and pleasure. These systems have been greatly added to the demands on the battery in modern electrical devices. LabVIEW based battery monitoring system has been developed for electrical devices and ready to use for any battery powered system to adopt safety, convenience and pleasure. The developed LabVIEW based battery management monitors different parameters of the rechargeable battery. The developed system is very much essential for optimum utilization of the rechargeable battery. This system will be useful for manufacturer and user of the electrical device to understand condition and health of the rechargeable battery so that it is easy to take decision of recharging the battery or replace the battery.

Real-time systems are computer systems that are prone to monitor, respond to, or control external environmental parameters. In this research work of BMS the attempt is made to design a battery monitoring system (BMS) of the electrical devices using LabVIEW. This system comprises real time platform for read, process, monitor and stores the acquired data for further analysis. This developed system is useful in every battery powered systems and electrical vehicle for battery capacity.



In this figure the system provides the clear idea of the BMS performance with respect to the factors like temperature, load connected. The data acquisition system acquires battery voltage, battery temperature and discharging current from the battery through developed signal conditioning circuits. This signal conditioning circuits for battery parameters sensing has already experimented in the previous sections of this chapter. The various inputs and outputs sections can be seen in the block diagram of the battery monitoring system. Battery temperature, state of charge status and terminal voltage are the outputs of the BMS whereas ampere-hour value of the battery are the inputs of the BMS system. The system user has to feed appropriate information to the system and then system setup will provide proper information to the user.

IV. LITERATURE SURVEY

A battery management system (BMS) is an electronic regulator that monitors and controls the charging and discharging of rechargeable batteries, keeping a check on the key operational parameters during charging and discharging such as voltages, currents and the battery internal and ambient temperature. The monitoring circuits would normally provide inputs to protection devices which would disconnect the battery from the load or charger any of the parameters like overcharge, undercharge, high temperature, become out of limits. The battery management system (BMS) is a critical component of electric and hybrid electric vehicles. The purpose of the BMS is to guarantee safe and reliable battery operation. To maintain the safety and reliability of the battery, state monitoring and evaluation, charge control, and cell balancing are functionalities that have been implemented in BMS.

This paper mainly discusses a distributed battery management system (BMS) that used for hybrid electrical vehicle (HEV) and the research on Lithium-ion and the research on Lithium-ion battery based on the model of PNGV. The BMS presented is composed with the distributed and integrated module, the distributed modules(DM) takes charge of measuring the parameters of voltage and temperature accurately and in time, communicate with the integrated module(IM) by CAN bus. The IM takes charge of estimating Lithium-ion batteriespsila state of charge (SOC) based on the data of DM and PNGV model. According to the complicated electromagnetism condition the anti-jamming methods are used between every part of the BMS to have the characters of robustness and reliability. According to the non-liner feature of Lithium-ion battery, PNGV model has the high accuracy to reflect the open circuit voltage (OCV) and SOC. Results show that the BMS has the characteristics of easy to expansion, high precision, working reliability and the PNGV model is suitable for Lithium-ion battery. Bluetooth module. Path is identified by the aggrandized genetic algorithm which is best. Here, they failed to communication range for long distance.

[3] For safe and reliable operation of lithium-ion batteries on electric vehicles (EVs), the online monitoring of the batteries is necessary. To make it convenient for owner of the vehicle to monitor the battery status of their vehicles anytime and anywhere, here in this paper a real-time Android-based monitoring system for lithium-ion batteries on Electric Vehicles is designed, which achieves an integration monitoring system of batteries, phones, batteries on Electric Vehicles is designed, which achieves an integration monitoring system of batteries, phones, computers for owners and repairs. The system is composed of an on-board monitoring device, android phone client, web based application. Web based application collects and displays the

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batteries operation parameters through Cloud Server Link. To verify the feasibility of the real-time monitoring system we present Prototype. Results show that the batteries data is transmitted to owner's phone and displayed on it through web based Application, which could help users monitor the batteries status conveniently.

A. Batteries

General Description

The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the earliest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors.

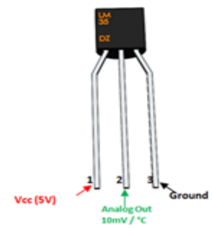
B. DC Motors:

This high-power, 130-size brushed DC motor can be used as a direct replacement for lower-power 130-size motors to get more torque and speed out of your gearmotor, but it will also draw more current and typically wear out faster. It has a recommended operating voltage of 1.5 V to 3 V, but it can operate at higher voltages to provide more power in exchange for longevity of the motor. It is compatible with the larger Pololu plastic gear motors.

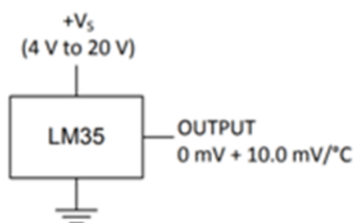
Specifications:

- Voltage – 3V
- RPM - 20,000
- free-run current -350 mA
- stall current - 4 A
- stall torque - 55 gf-cm

C. LM35 Temperature Sensor:



The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. TheLM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range.



If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature.

Pin Configuration:

Pin Number	**Pin Name**	**Description**
1	Vcc	Input voltage is +5V for applications
2	Analog Out	increase in 10mV raise of every 1°C.
3	Ground	Connected to ground of circuit

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D. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 16MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

How to Use Arduino Board:

The 14-digital input/output pins can be used as input or output pins by using pinMode (), digital Read () and digitalWrite () functions in arduino programming. Each pin operates at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below

- *Serial Pins 0 (Rx) and 1 (Tx):* Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- *External Interrupt Pins 2 and 3:* These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- *PWM Pins 3, 5, 6, 9 and 11:* These pins provide an 8-bit PWM output by using analog Write () function.
- *SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK):* These pins are used for SPI communication.
- *In-built LED Pin 13:* This pin is connected with a built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.
- Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits of resolution, i.e. 1024 different values. They measure from 0 to 5 volts but this limit can be increased by using an AREF pin with analog Reference () function.
- Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using the Wire library.

Arduino Uno has a couple of other pins as explained below:

- *AREF:* Used to provide reference voltage for analog inputs with analog Reference () function.
- *Reset Pin:* Making this pin LOW, resets the microcontroller.

V. INTRODUCTION TO LAB VIEW

LabVIEW is a graphical programming language that shares some aspects with traditional non-graphical programming languages (C, Pascal etc.,) and some aspects of hardware definition languages (VHDL, Verilog). Namely, it combines the generality and power of traditional programming data structures such as loops, if-then branches, and arithmetic operators with the ability of hardware definition languages to perform multiple tasks simultaneously.

Programming in a graphical environment consists of placing functional blocks that perform specific tasks on a worksheet and wiring them together to send data from one block to another. These blocks can do anything from simple tasks (add the data on two input wires together and place the answer on the output wire) to complex tasks (take two arrays of data as input and display the contents on a log-log graph as x, y pairs).

These functional blocks can also translate data in the graphical program into a form that external equipment can use Fig 3.1, shows the icon of NI.

LabVIEW helps introduce the power of computers in engineering today. Although you are not an electrical engineering major. LabVIEW can be used to control any instrument that complies with the IEEE 488.2 standard, using GPIB-General Purpose Interface Bus. Graphical programming languages provide a different method of coding. Instead of the high-level statements in procedural languages, like C and Object-Oriented languages like C++ or Java, graphical languages are coded by selecting objects, connecting them, and adding functionality.

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High level languages allow developers to design programs by focusing on the tasks required. The programs are developed using the statements provided and must be compiled and linked, producing an executable file of machine level code. When executed, the code is stepped through and directs the processor to perform operations. Graphical languages usually are developed using a graphical interface, where elements are selected and the underlying sections. The details are dependent on the language. LabVIEW is a product of National Instruments (NI). t requires licenses, although student and trial packages are available. You can learn more about LabVIEW at the LabVIEW Maker Hub. A student edition was used for this article. Files created have a file type of Vi. Installed, LabVIEW presents an integrated development, test and run environment. LabVIEW was designed to support a laboratory environment and is targeted to applications to control and monitor equipment. To support this effort, NI has a wide selection of hardware interfaces and meters to enable LabVIEW programs to monitor and control electronic equipment. Signals from the hardware interfaces can be read directly by the program and the data acted upon. There are also simulation controls, file read/write and circuit controls. Knowing the engineering behind the process to be controlled and measured is as important as knowing LabVIEW.

VI. Output And Results

On electric device dash board electronic systems with safety, convenience, comfort and pleasure are demanded from the customer to the manufacturer. Therefore, the LabVIEW based battery monitoring system has been used for especially for electrical devices to monitor battery parameters and gives convenience to the user. The developed LabVIEW based battery management monitors different parameters of the rechargeable battery i.e. terminal voltage, temperature, state of charge and depth of discharge and Load monitoring system. The front panel of this designed system has shown in figure will give iconic or symbolic information along with digital numbers and graphical information of temperature, load voltage, terminal voltage and state of charge. The different batteries are used to study and experiment with developed prototype of LabVIEW based Battery management system right from 2.5AH to 65AH flooded and un flooded types. In this project 4V Rechargeable Lead acid battery.

The hardware part which has the reference battery to be measured, an Arduino processor, load and the power source for battery getting charged. This is connected to the system installed with the LabVIEW and then the system is gotten to run.

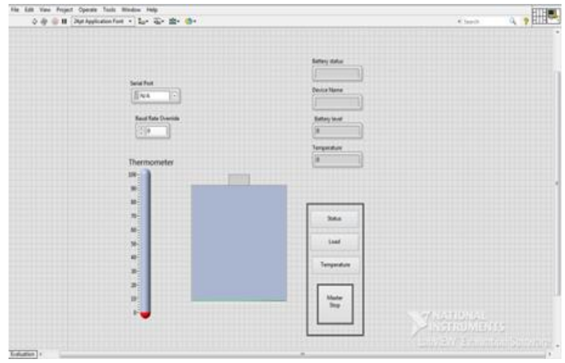

Fig.2.Front panel View of BMS

The front panel shows the parameters like the device name which is connected to it i.e., Arduino and the baud rate of 9600, the battery status whether the battery is full or emptied and the level of the battery in the form of percentage. It shows the results wanted in the Graphical interface shown in the front panel when user select the option.

VII. Showing The Battery Status With Load

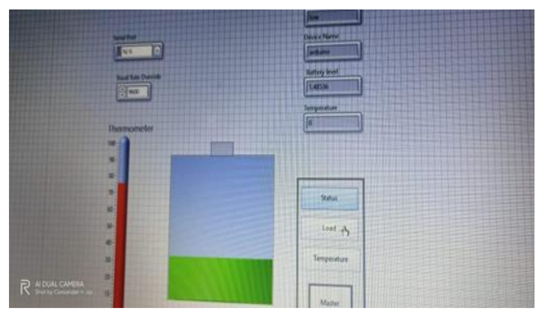

Fig.3. Front Panel of BMS with Load

Fig.3. shows the detection of the battery status when the load is increased or decreased with respect to the load connected. If the load gets increased the temperature sensor senses the temperature of the battery and the level of the battery gets decreased. If the load gets decreases the temperature decreases and the battery increases.

VIII. Conclusion And Future Enhancement

A. Conclusion

The Battery Monitoring System We Designed Will the Show the Required Parameters for Knowing the Present Status of the Battery I.E. Charging, Discharging Status, Temperature with Respect to The Load Connected and The Usage of the Battery and Is Used to Avoid Destroying and The Exhaust of the Battery by Knowing It in Prior.

B. Future Enhancement

The Battery Monitoring System can be enhanced by automatically managing the undesired parameters. The future enhancement of this project is by managing the high temperature, high load by indication and that automatically changing certain parameters that would certainly help in smooth running of the battery.

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